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PREFACE

In August 1959, the President directed the Secretary of Health, Education, and Welfare to intensify Departmental activities in the field of radiological health. The Department was assigned, among other things, primary responsibility within the Executive Branch for the collation, analysis, and interpretation of data on environmental radiation levels. Within the Department this responsibility has been delegated to the Division of Radiological Health, Public Health Service.

As a step in the discharge of this responsibility, the Public Health Service is initiating this monthly publication. The data have been submitted by agencies of the Federal government, by States, and by other sources. Each third report, starting July 1960 will contain interpretative statements as well as data.

The monthly and quarterly reports will be reviewed by a Board of Editorial Advisors with representatives from the following Federal agencies:

Department of Health, Education, and Welfare
Atomic Energy Commission
Department of Defense
Department of Commerce
Department of Agriculture

Reprinted January, 1964

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SECTION I

INTERPRETATIONS OF RADIATION LEVELS

A usual procedure for establishing criteria of occupational exposure to ionizing radiation is to set a maximum permissible radiation dose to an organ or organs over a specified period of time. This dose is then used for establishing permissible external radiation levels and for calculating maximum permissible concentrations of radionuclides in water and air. The maximum permissible concentration (MPC) of a radionuclide in water and air is a concentration of that nuclide which would, by itself, result in the maximum permissible personnel exposure if ingested or inhaled over the specified time. Obviously such calculations of MPC's require the use of many assumptions which are based on the best current information. As newer and better information and interpretations are developed, better estimates and calculations may be made of doses to the body resulting from given environmental contamination levels. However, the basic criterion remains that of permissible radiation doses to the body.

The concept of maximum permissible concentrations of radionuclides in water and air was developed initially for atomic energy workers. By applying certain conversion factors it has been used in the past for the general population. The table below summarizes the maximum permissible concentrations for some single radionuclides in water and air as applied to occupational exposures.

National Committee on Radiation Protection and Measurements (NCRP)

In the release (April 23, 1959) accompanying the issuance of recommendations on maximum permissible amounts of radionuclides in the human body and maximum permissible concentrations in air and water (National Bureau of Standards Handbook 69), it was stated* by the National Committee on Radiation Protection:

> "... Exposure of the whole population to natural and man-made sources of radiation presents a different problem and involves many factors beyond technical control. The NCRP reports, thus far, contain recommendations only on matters that are subject to control. The recommended values for MPD's and MPC's apply specifically only to occupational conditions and in the neighborhood of controlled

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*The full statement may be found in "National Committee on Radiation Protection and Measurements (NCRP), Summary of NBS Handbook 69." The American Journal of Roentgenology, Radium Therapy and Nuclear Medicine, Vol. 82, No. 2, Aug. 1959, p. 342-345

TABLE I. MAXIMUM PERMISSIBLE CONCENTRATIONS FOR RADIONUCLIDES IN WATER AND IN AIR FOR OCCUPATIONAL EXPOSURE(a)

	NCRP				ICRP(b)	
	Handbook #52		Handbook #69 (Superseding #52)		Water(c)	Air(d)
	Water(c)	Air(d)	Water(c)	Air(d)		
Strontium-90	800	200	1,000	100	1,000	100
Strontium-89	70,000	20,000	100,000	10,000	100,000	10,000
Cesium-137	1,500,000	200,000	200,000	20,000	200,000	20,000
Barium-140	2,000,000	60,000	300,000	60,000	300,000	60,000
Iodine-131	30,000	3,000	20,000	3,000	20,000	3,000
Radium-226	40	8	100	10	100	10

(a) For 168 hour week for occupational exposure
(b) Announced values pending publication of report
(c) Micromicrocuries per liter
(d) Micromicrocuries per cubic meter

areas which are attributable to operations within the controlled area. Until more specific information is available, it is believed that with the exercise of some judgment similar principles may be applied as guides in application to problems involving exposure of the whole population to radiation.

"The ICRP has made some tentative recommendations relative to whole population exposure. These are designed for long-range planning purposes and in this connection the NCRP considers them to be sound. They are not, however, subject to direct control in the immediate future. In the meantime the NCRP considers that undue risks to the population will not be incurred by following current policies for a while longer, during which time it is hoped that methods may be established for a meaningful analysis and control of population exposure..."

In releasing the report of an Ad Hoc Committee* it was stated,

"... This report" (the Ad Hoc Committee report) "is, therefore, being referred to NCRP subcommittee I on 'Maximum Permissible Dose Criteria' for further consideration and the possible formulation of specific values to be recommended as the maximum permissible dose. Pending the possible formulation and approval of such recommendations, the NCRP recommends the use of the current recommendations of the ICRP concerning permissible doses for the population..."

The International Commission on Radiation Protection (ICRP)

The most limiting recommendations of the International Commission on Radiation Protection are concerned with the exposure of the whole population and are based on the concept of a genetic dose as follows:

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*Somatic Radiation Dose for the General Population, Ad Hoc Committee of the National Committee on Radiation Protection and Measurements. Science, Vol. 131, No. 3399, Feb. 19, 1960, p. 482-486.

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> "... It is suggested that the genetic dose ... to the whole population from all sources additional to the natural background should not exceed 5 rems plus the lowest practicable contribution from medical exposure ..."

This applies to the assumed thirty year period of reproductive life. Further, the ICRP states:

> "... The Commission does not wish to make any firm recommendations as to the apportionment of the genetic dose of 5 rems but, for guidance, gives the following apportionment as an illustration.

(A)	Occupational exposure	1.0 rem
(B)	Exposure of special groups	0.5 rem
(C)	Exposure of the population at large	2.0 rems
	Reserve	1.5 rems

> "... The apportionment of 2.0 rems (with a long-term reserve of 1.5 rems for possible eventualities) for the genetic exposure of the population at large is intended for planning purposes in the development of nuclear energy programs (with the associated waste disposal problems) and more extensive uses of radiation sources. In the case of internal exposure, the radioisotopes of interest are those that contribute to the gonad dose directly (by local concentration) or indirectly (by radiation produced elsewhere in the body). In either case the maximum permissible concentrations in air and water of these isotopes recommended by Committee II for continuous occupational exposure ('168-hour week') are based on an average yearly dose of 5 rems in the gonads or the whole body. If for these isotopes the average concentrations in public air and water supplies are lower than the values recommended for continuous occupational exposure by a factor of 1/100, the genetic dose to the population would amount to 1.5 rems (5 x 1/100 rems/year in the gonads x 30 years = 1.5 rems). In this case the contribution from external sources should be limited to 0.5 rem in order not to exceed the total of 2 rems ..."

Concerning somatic dose the ICRP states:

> "... No specific recommendations are made at this time as to the maximum permissible 'somatically' relevant dose to the population. However, it is expected that the maximum permissible limits of the individual total doses recommended ... will keep the average dose in any tissue at such a level that the injuries that could possibly occur in a population would be well within acceptable limits ..."

> "In the case of external exposure of the whole body to penetrating radiation the restriction imposed by the genetic dose to the population automatically reduces the doses to internal organs below the individual maximum permissible annual doses recommended ... The same thing applies to internal exposure resulting from radioisotopes that directly or indirectly contribute to the gonad dose of a population..."

> "There remain for further consideration those isotopes that concentrate in specific organs (other than the gonads). In view of the existing uncertainty as to the dose-effect relationships for somatic effects, it is suggested that for planning purposes the average concentrations of such isotopes, or mixtures thereof, in air or water, applicable to the population at large, should not exceed one-thirtieth of the MPC values for continuous occupational exposure given in the report of Committee II ..."

In the ICRP report there is a distinction made between criteria intended for planning purposes in designing atomic energy programs relative to exposures to the average person in a population (a factor of 1/30 applied to occupational values) versus a maximum dose for individuals in the population at large (a factor of 1/10 applied to occupational values).

In a set of statements clarifying its original recommendations,[*] the ICRP stated,

> "... The size of a 'group' or a 'population' is a relative concept and it is often difficult to decide whether a group should be considered 'large' and whether relatively small national populations should be referred to as the 'whole' population with respect to exposures of which the importance depends on the size of the group exposed. The size of a group is irrelevant in the case of individual exposure, where groups are defined only to distinguish between individuals for whom the recommended maximum permissible doses are different for various reasons or for whom the membership of a certain group[†] provides for more specific recommendations with regard to individual monitoring, medical examinations, and surveys of the protection conditions. In the case of, e.g., average exposure, however, the 'whole' population is involved and the responsibility for the interpretation of this concept will rest with national and international administrative authorities responsible for the legal application of protection requirements."

Such deliberations indicate both the statistical nature of evaluating potential biological hazards from relatively low chronic levels of radiation and the necessity of employing value judgments in reaching decisions on radiation protection criteria.

Ad Hoc Committee of the National Committee on Radiation Protection and Measurements

The report of an Ad Hoc Committee of the National Committee on Radiation Protection and Measurements was published in February 1960.[‡] This committee clearly stated the necessity of exercising value judgments in reaching decisions on radiation protection.

> "... if a maximum permissible dose is determined, it will necessarily be at an arbitrary level where, in the judgment of those choosing the level, the risk is acceptable as compared to the benefits. Every effort should be made to maintain the actual dose as far below the permissible level as possible ..."

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[*] "Report on Decisions of the 1959 Meeting of the International Commission on Radiological Protection (ICRP)." Radiology. Vol. 74, No. 1, January 1960, p. 116-119.

[†] Editor's note: The ICRP established the following categories of exposures:

A. Occupational exposure.
B. Exposure of special groups:
  1. Adults who work in the vicinity of controlled areas, but who are not themselves employed on work causing exposure to radiation.
  2. Adults who enter controlled areas occasionally in the course of their duties, but are not regarded as radiation workers.
  3. Members of the public living in the neighborhood of controlled areas.
C. Exposure of the population at large.
D. Medical exposure.

[‡] Somatic Radiation Dose for the General Population, Ad Hoc Committee of the National Committee on Radiation Protection and Measurements. Science, Vol. 131, No. 3399, Feb. 19, 1960, p. 482-486.

The same committee concluded,

> "... Although it is not our responsibility to determine the exact level, we believe that the population permissible somatic dose from man-made radiations, excluding medical and dental sources, should not be larger than that due to natural background radiation, without a careful examination of the reasons for, and the expected benefits to society from a larger dose..."

The committee also recommended,

> "... that it should be allowable to average doses over a suitably long period of time, e.g. one year, and over population groups approximating the size of a state or major city..."

and

> "... it is recognized that for some radioisotopes, environmental levels may conceivably result in higher radiation doses to children than to adults. In such cases, permissible levels should apply to radiation doses received in the age ranges of highest dose, rather than to the population group as a whole...".

Summary of Statements on Interpretations of Radiation Levels

A complete discussion of establishing radiation exposure standards for the general population is too lengthy and complex to be attempted here. However, a few relevant points may be enumerated.

a. In light of the present day uncertainties of dose-response relationships, especially at low levels of radiation, it may be prudent to assume a linear relationship, i.e., no threshold exists and there is no dependence upon rate of delivery of radiation exposure. This means, among other things that, "... even the smallest dose involves some risk..."* In other words, there is no arbitrary value that may be established below which there is absolute safety and above which there is imminent hazard. Therefore, the establishment of any set of radiation standards must require the exercise of value judgments that are not restricted to technical considerations only, i.e., there must be a balancing of social benefits against biological risks.

b. The basic biological criterion is the amount of radiation exposure over a given period of time to a given organ or organs and for a given segment of the population. The setting of MPC values for radionuclides in water and air is the result of calculations, based on certain assumptions, which would result in this maximum personnel exposure. Criteria applicable to select occupational workers who are under close ar constant surveillance, who knowingly and voluntarily accept the potential risks of suc

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*"Somatic Radiation Dose for the General Population," Ad Hoc Committee of the National Committee on Radiation Protection and Measurements. Science, Vol. 131, No. 3399, Feb. 19, 1960, p. 482-486.

employment and who may leave such employment, may not be directly translatable by a simple conversion factor to the general population consisting of persons of varying ages and status of health who may be unknowingly subjected to some radiation risks and who may have little choice but to live in such an environment.

c. In calculating radiation doses all sources should be considered and the doses therefrom summated, i.e., doses to the whole body are additive for all organs and likewise all doses to a given organ from various isotopes deposited therein are additive. Thus, MPC's for water and air assumes that only one radionuclide is the source of exposure to an organ or organs. If multiple radionuclides are present and/or if external radiation is also present as sources of exposure to an organ or organs then each source must be evaluated on a proportionate prorated basis, i.e., the individual MPC's must be lowered proportionately. Equally correct, standards of MCP's for foods apply to the whole diet. If an individual radionuclide in a single food item is selected for consideration, estimations should be made of its fractional contribution, after due account is made of the contributions or radiation doses from other sources.

d. In dealing with low levels of radiation, it is the average exposure over relatively long periods of time that is important, and transient peaks and valleys in the concentration values of long-lived radioactive materials in the environment may not be critical. Short-lived isotopes, of course, deliver their total energy in proportionately short time. Biological responses may be dose rate dependent, but at relatively low levels of radiation, the principal factor still is though to be the average exposure.

The determination of the degree and nature - type of radionuclides - of environmental contamination (which probably will be ever-changing), the study of movement of radionuclides in the biosphere, the estimations of intake, deposition and retention of radioactive material in the body, the calculation of radiation doses, and the necessary increased basic understandings of doses versus biological effects constitute sets of problems that will hold the attention of scientists in many fields for years to come. More definitive answers to these problems must await the advancement of science on many fronts. In the meantime we must apply our best knowledge concerning radiation and its effects to develop criteria of radiation protection consistent with the benefits to be derived from the use of atomic energy.

Just as a balance must be struck when weighing potential biological risks from radiation versus the benefits, likewise, perspective must be maintained when evaluating the contributions of various sources of radiation exposures to the total exposure, i.e., X-rays, fallout, etc.

With the active studies currently underway by the Federal Radiation Council and with the continuous appraisal of these problems by the NCRP and ICRP, it is anticipated that more definitive statements concerning criteria of radiation exposures other than for the atomic energy worker will be forthcoming. Until such time, the above discussion attempts to provide some background for evaluating the environmental contamination data contained in this report.

SECTION II

MILK

PUBLIC HEALTH SERVICE MILK MONITORING PROGRAM

The U. S. Public Health Service Milk Monitoring Network presently consists of 12 sampling stations. This will be expanded to about 60 stations by the summer of 1960.

The initial purpose of establishing this network was in keeping with the normal and continuing program of the Department of Health, Education, and Welfare to determine trends in our changing environment, including measurement of amounts of radioactivity in water, air, milk, and other foods. Milk was the food chosen for initial testing since it is among the most important elements of the diet and is constantly available at all seasons of the year and in all climates. A primary objective of the project was to develop and simplify methods of collection and radiochemical analysis of milk to make them more suitable for larger scale programs.

The selection of the present 12 sampling stations was based on the following criteria:

1. The milk represented in each sample was from a group of farms milking a total of at least 1,000 cows.

2. The number of individual farms was small enough so that collection of collateral field data from each farm was feasible.

3. The milk samples were from a supply that was part of a metropolitan milkshed.

4. The conditions under which the milk was received were such that each sample was representative of the same farms in the production area.

The Overton, Nevada and St. George, Utah milksheds do not fulfill the 1,000 cow minimum requirement but have been included since they are part of the monitoring program around the Nevada Test Site.

One gallon samples are collected once each month and forwarded by air parcel post to the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, for radionuclide analysis. It is estimated that these samples represent 2,000 gallon lots. The concentration of iodine-131, barium-140, and cesium-137 and naturally occurring potassium-40 are all currently being measured when present in the milk by gamma scintillation spectroscopy. Total strontium and strontium-90 are determined following radiochemical separations, and the strontium-90 is calculated by measuring the build-up of the daughter decay product, yttrium-90 (after about a two week wait) using a low background anticoincidence beta counter. The total radioactive strontium is counted in a shielded internal proportional counter with the strontium-90 calculated as the difference.

Publication of the data will normally require a period of about three months after collection due to shipment, processing, decay product build-up, compilation of the data, and inclusion with other radiation data in the monthly reports.

A description of the program appears in "The Occurrence of Strontium-90, Iodine-131 and Other Radionuclides in Milk, May 1957 through April 1958," by J. E. Campbell, G. K. Murthy, A. S. Goldin, H. B. Robinson, C. P. Straub, F. J. Weber, and K. H. Lewis, American Journal of Public Health, Vol. 49, No. 2, Feb. 1959, American Public Health Association, reprinted by the Joint Committee on Atomic Energy Hearings on Fallout from Nuclear Weapons Tests, Vol. 1, May 1959.

Detailed technical descriptions of the methodology of analyses are listed below:

"Determination of I-131, Cs-137 and Ba-140 in Fluid Milk by Gamma Spectroscopy." By G. R. Gagee, G. R. Karches and A. S. Goldin, Public Health Service.

"A Method for the Rapid Ashing of Milk for Radionuclide Analysis," Journal of Dairy Science, 42-1288, Aug. 1959. By G. K. Murthy, J. E. Campbell.

"A Method for the Determination of Radionuclides in Milk Ash," Journal of Dairy Science, 14-1276, Aug. 1959. By G. K. Murthy, L. P. Jarnagin, and A. S. Goldin.

"A Method for the Elimination of Ashing in Strontium-90 Determination of Milk," Journal of Dairy Sciences, 43 (2) 151, Feb. 1960. By G. K. Murthy, J. E. Coakley and J. E. Campbell.

TABLE II. PUBLIC HEALTH SERVICE DATA ON RADIOACTIVITY IN MILK

November 1959

Data from one sampling point supplying the cities listed below

Radioactivity in $\mu\mu c$/liter

Area	Calcium grams/liter		Iodine-131		Strontium-89		Strontium-90		Barium-140		Cesium-137	
	Nov.	Yearly Average	Nov.	Yearly Average	Nov.	Yearly Average	Nov.	Yearly Average	Nov.	Yearly Average	Nov.	Yearly Average
Atlanta, Ga.	1.06	1.18	(a) 0	5	0	47	16	15	0	1	40	87
Austin, Tex.	1.05	1.13	0	6	0	26	5	6	0	1	25	49
Chicago, Ill.	1.05	1.10	0	3	0	13	8	8	0	1	40	59
Cincinnati, Ohio	1.15	1.13	0	2	0	22	12	13	0	1	40	52
Fargo, N. D., Moorhead, Minn.	1.02	1.12	0	2	0	19	14	14	0	<1	40	62
New York, N.Y.	1.09	1.08	0	2	0	9	9	9	0	<1	35	55
Overton, Nev. (b)	1.04	1.06	0	<1	0	2	3	3	0	0	15	31
Sacramento, Cal.	1.07	1.11	0	2	0	14	6	5	0	<1	15	46
Salt Lake City, Utah	1.09	1.12	0	3	0	9	5	7	0	<1	35	44
Spokane, Wash.	1.09	1.18	0	6	0	23	12	12	0	1	50	70
St. George, Utah (c)	1.06	1.11	0	1	0	5	3	5	0	0	20	32
St. Louis, Mo.	1.32	1.25	0	3	0	68	24	21	0	3	40	82

(a) Zero means below detectability.

(b) Average includes 9 months - start of the regular monthly collections.

(c) Average includes 8 months - start of the regular monthly collections.

ATOMIC ENERGY COMMISSION DATA ON RADIOACTIVITY IN MILK

Routine milk monitoring is conducted at New York City, Perry, New York, and Mandan, North Dakota, with analyses performed at the Atomic Energy Commission's New York Health and Safety Laboratory. Data for these three locations for the month of October 1959 are presented below. Data for previous months were given in HASL-77, pp. 85-90.*

TABLE III. STRONTIUM-90 AND CALCIUM IN OCTOBER 1959 MILK

Health and Safety Laboratory (HASL) Sampling Locations

	μμc strontium-90 per			Sr^{89}/Sr^{90} at midpoint of sampling month
	liter	kg (powder)	g Ca	
Perry, N.Y. (Powdered whole milk)		97.8 ± 4.2	10.5 ± 0.4	0.6
New York City (Whole liquid milk)	8.09 ± 0.32		8.27 ± 0.32	0.7
Mandan, N.D. (Powdered buttermilk)		233 ± 8	20.9 ± 0.7	0.5

	grams Ca per	
	liter	kg (powder)
Perry, N.Y. (Powdered whole milk)		9.33
New York City (Whole liquid milk)	0.98	
Mandan, N.D. (Powdered buttermilk)		11.1

STATE OF MINNESOTA MILK DATA

Many of the states are rapidly developing programs of radiological health. Minnesota is one of these and has published Radiation Surveillance Studies (Summary report for the period October 1957 to August 1959) by the Minnesota Department of Health, Division of Environmental Sanitation. This report has been transmitted to the U. S. Public Health Service and abstracts of some data are reproduced below. Other states are invited to transmit similar summarized data for possible inclusion in these monthly and quarterly reports.

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*Health and Safety Laboratory Strontium Program Quarterly Summary Report, January 1, 1960, available from the Office of Technical Services, Department of Commerce, Washington 25, D. C., for $3.50.

MINNESOTA DEPARTMENT OF HEALTH
Division of Environmental Sanitation

RADIATION SURVEILLANCE STUDIES

Summary Report for the Period
October 1957 to August 1959

"Strontium-90 in Milk

Strontium-90 is considered to be one of the most hazardous materials in fallout for several reasons. First, a relatively large amount of Strontium-90 is produced in the fission reaction; second, it has relatively long radiological half life (i.e., time in which activity is reduced to 1/2 of its initial value) of 28 years; and thirdly, it is chemically similar to calcium, and is metabolized by the body in the same manner as that element. Because of this latter property, the strontium-90 is largely deposited in the bone. Since milk is the main source of calcium in the American diet, it is a general practice to analyze milk for its strontium-90 content as an index of the potential exposure of the population to this element.

"Early findings of studies conducted by the U. S. Public Health Service and the U. S. Atomic Energy Commission indicated that levels of strontium-90 in milk were somewhat higher in the upper midwest than in other parts of the country. Since there were no data on Minnesota milk, and no good way of estimating the levels from other data, a small milk surveillance network was started in September 1958.

"Initially, milk was collected from the prime milk processor in the following locations: Brainerd, Duluth, Faribault, Minneapolis, and Thief River Falls. Subsequently, Rochester replaced Faribault and Worthington was added to the network. At each of these stations, daily (2 ounce) samples are collected and composited, and each month, the composite sample is sent to the department laboratories for analysis. The milk is collected at the bottling machine so that the sample should be randomly representative of the milk produced in that milk shed.

"Table XI shows the average concentrations of strontium-90 in milk by month.

TABLE XI

Strontium-90 in Minnesota Milk
September 1958 - August 1959

Month	Number of Samples	µµc Sr-90/liter milk
Sept.	3	18.9
Oct.	3	12.7
Nov.	5	15.5
Dec.	5	13.3
Jan.	5	15.9
Feb.	5	13.4
Mar.	5	13.5
Apr.	4	12.6
May	4	19.6
June	5	20.7
July	4	14.9
Aug.	4	10.4

"For comparison purposes, the N.C.R.P. recommends a maximum permissible concentration of 100 micromicrocuries of strontium-90 per liter of water, and this figure is generally accepted for milk.* Thus the maximum average level in Minnesota is approximately 20% of the recommended maximum level. The sudden increase in May, 1959 is probably attributable to the fact that around that time the cattle returned to pasture on which a winter's fallout had accumulated. The levels appear to be decreasing in recent months, again probably as a result of the cessation of nuclear weapon tests.

"Throughout the duration of this program, to date, there has been a consistent variation of as much as two fold and more in the concentration of strontium-90 in milk collected at the different sampling points. It would not seem probable that the variation was due to local variations in fallout patterns. Interest in the cause of this variation prompted the department to make a survey of the milk from individual dairy farms in one of the sampling sheds. Again a consistent variation of as much as two has been found between farms within an area of 60 square miles. A detailed study of the entire environment of the cattle in this area is now under progress in an attempt to determine the cause of this fluctuation. The program is being carried on with the cooperation of the University of Minnesota School of Agriculture."

MINNESOTA DEPARTMENT OF HEALTH
SECTION OF PUBLIC HEALTH EDUCATION
UNIVERSITY CAMPUS
MINNEAPOLIS 14, MINNESOTA
FEDERAL 9-7751

February 5, 1960

FOR RELEASE: Saturday, February 6, 1960

SUBJECT: Health Department Reports Latest Findings of Strontium-90 Levels in Milk

Investigations by the Minnesota Department of Health of Strontium-90 levels in milk produced in the state during the six month period from May 1, 1959, to October 31, 1959, reveal an average concentration of 14.3 micromicrocuries per liter in 28 samples taken at six sampling stations.

This level represents only about 14 per cent of the maximum permissible level for lifetime exposure, according to Dr. Robert N. Barr, executive officer of the State Health Department.

The average concentration of Strontium-90 in 35 milk samples collected during the first eight months of this program was 14.4 micromicrocuries per liter, essentially the same concentration as that for the most recent tests. Since June 1959, the concentration of Strontium-90 has steadily decreased. Strontium-90 levels in milk produced in the upper midwest are generally higher than the national averages reported by the U. S. Public Health Service. The latter have shown the same decreasing trend in recent months.

All of the individual samples collected in Minnesota have been well within the permissible maximum of 100 micromicrocuries per liter, a figure set by the National Committee on Radiation Protection and Measurement. The range and average of the readings also compare generally with those reported by the U. S. Public Health Service in recent months.

In September 1958, the average of the state samples was 18.9, compared to the national average of 8.4 micromicrocuries per liter. In April, 1959, the national average reached 9.1, compared to 12.6 in Minnesota. In September, the most recent month for which data is available on both state and national averages, the Minnesota average is 10.6, and the national average is 6.0.

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*Editor's Note: Please see discussion on "Interpretations of Radiation Levels," page 1.

The levels in the 28 milk samples in Minnesota in the period May to October 1959, ranged from a low of 5.4 micromicrocuries per liter to a high of 32.4. Dr. Barr points out that the high reading, taken in June 1959, was still far below the maximum permissible level for lifetime exposure.

A micromicrocurie is the radiation equivalent of one millionth of one millionth of a gram of radium, and a liter is just slightly more than one quart. The units of measurement are the same as those used by the U. S. Public Health Service in its milk surveillance program. Milk samples are now collected at Brainerd, Duluth, Minneapolis, Rochester, Thief River Falls, and Worthington. These sites were selected to give as wide a geographical coverage as possible, as well as to cover the major population areas of the state.

The Minnesota milk tests are part of a program to investigate all aspects of the potential health hazards associated with ionizing radiation sources. Milk was selected for testing because it is probably the principal source in the human diet of Strontium-90, one of the most hazardous to the public health of the radioactive materials. It is extremely difficult to make an exact evaluation of the hazard of a given concentration of radioactive material, such as Strontium-90. At the present state of knowledge, only an estimation of the relative hazard, based on presently accepted standards, is possible.

All levels of Strontium-90 found in milk samples in Minnesota to date have been well within presently accepted maximum permissible concentrations for that isotope. However, from the start of the program there have been consistent variations between levels found at the various sampling locations of as much as two fold at a given time. A more intensive study of the various phases of the environment to find a possible explanation for this phenomenon is now being conducted in the Brainerd milk shed cooperatively by the State Health Department and the Institute of Agriculture of the University of Minnesota. The U. S. Public Health Service has tentatively agreed to support the continuation and expansion of this program in the near future.

Summary Statements on Environmental Sampling Programs

As a service to those concerned directly with the many radiation environmental sampling programs, summary statements will be published as soon as completed showing the organization of these programs. The first of these statements follows dealing with milk monitoring programs. This compilation does not purport to be complete, but does encompass most of the major efforts.

Those in charge of any regularly conducted environmental monitoring programs are encouraged to report both the organizational and administrative aspects of their programs, and the data derived therefrom, for possible inclusion in these monthly reports.

TABLE IV. A SELECTED LIST OF ENVIRONMENTAL SAMPLING NETWORKS FOR ANALYSIS OF RADIOACTIVITY IN MILK*

Type of Sample	Operating Agency	Sponsoring Agency	Where Sampled	No. of Stations	Frequency of Sampling	Year Established
A. Milk	PHS	PHS	U.S.	12*	Monthly	1957
B. Milk	HASL	AEC	U.S.	3	Monthly	1954
C. Dried Milk	Los Alamos Lab.	AEC	U.S. and Foreign (Same as Lamont)	70	Weekly to Quarterly	1956
D. Milk	Minnesota Dept. of Health	Minnesota	Minnesota	6	2 oz. daily Composited Monthly	1958
E. Milk	Geochemical Lab., Lamont Geological Obs., Columbia Univ.	AEC	U.S. and Foreign (Same as Los Alamos)	70	Total 200/year	1954
F. Milk	Consumers Union	Consumers Union	U.S.	50 in '58 26 in '59	Two sets of samples	August 1958
G. Milk	Rad. Prot. Div., Dept. National Health & Welfare	Canada	Canada	16	Monthly	1954
H. Milk	Agricultural Res. Council, Radiological Laboratory	United Kingdom	United Kingdom	34	Monthly	1955

*To be expanded to about 60 by summer, 1960.

TABLE IV (Continued)

	Principal in Charge	Gross Radiation	Fission Products	Tracers	Natural Activity	Supplementary Analysis
A.	Dr. J. E. Campbell Robt. A. Taft Sanitary Engineering Center Cincinnati, Ohio	Beta	Sr^{89}, Sr^{90} I^{131}, Ba^{140}, Cs^{137}	---	---	Stable Ca
B.	Dr. John Harley HASL, AEC	---	Sr^{90}	---	---	Stable Ca
C.	Dr. E. C. Anderson LASL, AEC	---	Cs^{137}, Ba^{140}/La^{140}	---	K-40	Stable K
D.	Dr. R. N. Barr Secretary and Executive Officer, Minn. State Comm. of Health	---	Sr^{90}	---	---	Stable Ca
E.	Dr. A. R. Schulert Lamont Geo. Obs. Columbia U., NYC	---	Sr^{90}	---	---	Stable Ca
F.	Consumers Union	---	Sr^{90}	---	---	Stable Ca
G.	Dr. P. M. Bird, Rad. Prot. Div., Dept. National Health & Welfare, Canada	---	Sr^{90}	---	---	Stable Ca
H.	Dr. R. Scott Russell	---	Sr^{90}	---	---	Stable Ca

MILK NETWORKS

METHODS OF PUBLICATION OF DATA

A. Public Health Service:

PHS Monthly Press Releases

HASL-42 U. S. Atomic Energy Commission, "Environmental Contamination From Weapons Tests," Oct. 1958.

HASL-55 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," Feb. 24, 1959.

HASL-65 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," May 29, 1959.

HASL-69 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," Oct. 1, 1959.

HASL-77 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," Jan. 1, 1960.

"Statement on New Data on Uptake on Milk, Food and Bone." Dr. C. P. Straub, PHS, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Presented at Joint Committee on Atomic Energy Hearings on Fallout in May 1959, Volume 2, page 963.

The Occurrence of Strontium-90, Iodine-131, and Other Radionuclides in milk, May 1957 through April 1958. American Journal of Public Health, Vol. 49, No. 2, Feb. 1959. Reprinted in Joint Committee on Atomic Energy Hearings on Fallout from Nuclear Weapons Tests, Vol. I, May 1959, pages 186-196.

U. S. Atomic Energy Commission Quarterly Summary Statements on Fallout.

"Report on Radioactivity in Milk (1957-1959)." Dr. C. P. Straub, PHS, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Presented at Joint Committee on Atomic Energy Hearings on Fallout in May 1959, Vol. 2, page 197.

B. Health and Safety Laboratory, U. S. Atomic Energy Commission:

HASL-42 "Environmental Contamination From Weapons Tests." Note: A number of Milk Samples from different locations have been analyzed and reported by HASL-42.

HASL-55 AEC Strontium Program Quarterly Summary Reports, Feb. 2, 1959.

HASL-65 AEC Strontium Program Quarterly Summary Reports, May 29, 1959.

HASL-69 AEC Strontium Program Quarterly Summary Reports, Oct. 1, 1959.

HASL-77 AEC Strontium Program Quarterly Summary Reports, Jan. 1, 1960.

AEC Quarterly Summary Statements on Fallout.

AEC Statements at Joint Committee on Atomic Energy Hearings on Fallout. May 1957, Vol. I and II.

"Data on the Strontium-90 Content of Milk and Other Foods During 1958." By Dr. John H. Harley, HASL, AEC, at Joint Committee on Atomic Energy Hearings on Fallout, May 1959, Vol. 2.

C. Los Alamos Scientific Laboratory, U. S. Atomic Energy Commission:

HASL-42 "Environmental Contamination From Weapons Tests," Oct. 1958.

HASL-69 AEC Strontium Program Quarterly Summary Reports, Oct. 1, 1959.

HASL-77 AEC Strontium Program Quarterly Summary Reports, Jan. 1, 1960.

"Radioactivity of People and Foods," by E. C. Anderson, Robert L. Schuch, William R. Fisher, Wright Langham, *Science*, June 28, 1957.

"Radioactivity of People and Foods." Reprinted in Joint Committee on Atomic Energy Hearings on Fallout, May 1957, Vol. 1.

Dr. Wright Langham, LASL Statement at Joint Committee on Atomic Energy Hearings on Fallout, May 1959, Vol. 2.

AEC Quarterly Summary Statements on Fallout.

"Radioactivity of People and Milk," by E. C. Anderson, *Science*, Oct. 17, 1958.

"Ba-140 Radioactivity in Foods," by E. C. Anderson, R. L. Schuch, W. R. Fisher, and M. A. Van Dilla, *Science*, Feb. 7, 1958.

"Cs-137 Biospheric Contamination from Nuclear Weapons Tests," by W. H. Langham and E. C. Anderson, Health Physics 2, 30-48 (1959).

D. Minnesota Milk Network:

Minnesota Health Reports.

E. Lamont Geological Observatory:

Annual Reports.

HASL-42 "Environmental Contamination from Nuclear Tests," Oct. 1958.

Drs. J. L. Kulpand and A. R. Schulert, Statement before Joint Committee on Atomic Energy Hearings on Fallout, May 1957.

Dr. A. R. Schulert, Joint Committee on Atomic Energy Hearings on Fallout, May 1959.

J. L. Kulp, W. R. Eckelmann, and A. R. Schulert, "Strontium-90 in Man," Science, 125, page 219, 1957.

W. R. Eckelmann, J. L. Kulp, A. R. Schulert, "Strontium-90 in Man, II," Science, 127, pages 266-274, 1958.

J. L. Kulp, A. R. Schulert, E. J. Hodges, "Strontium-90 in Man, III," Science, 129, pages 1249-1255, 1959.

J. L. Kulp, R. Slakter, "Current Strontium-90 Level in Diet in United States," Science, July 11, 1958, pages 85-86.

J. L. Kulp, "World-Wide Distribution of Strontium-90 and its Uptake in Man," Bulletin of the Swiss Academy of Medical Sciences, Vol. 14, 1958, pages 419-433.

J. L. Kulp, R. Slakter, A. R. Schulert, "Strontium-90 in Food," Agricultural and Food Chemistry, Vol. 7, July 1959, page 466.

AEC Quarterly Summary Statements on Fallout.

F. Consumers Union:

Consumer Reports, March 1959, "The Milk We Drink." Reprinted in Joint Committee on Atomic Energy Hearings on Fallout, May 1959, Vol. 2.

Consumer Reports, Feb. 1960, "Fallout in Milk."

G. Canadian Milk Network:

"Levels of Strontium-90 in Canada up to May 1956," CRC-791. W. E. Grummitt and E. W. Carruthers.

"Levels of Strontium-90 in Canada up to December 1956," CRC-689. W. E. Grummitt and E. W. Carruthers.

"Levels of Strontium-90 in Canadian Milk Powder Samples up to the End of December 1958," CNHW (RP-Z). P. M. Bird and P. G. Mar. Reprinted in HASL-77, January 1960.

"Preliminary Report on the Measurements of Radioactive Strontium in Canadian Milk Powder Samples." CNHW (RP-1).

"An Intercomparison of Strontium-90 Results from Two Laboratories." CI-204. W. E. Grummitt and E. M. Robertson.

H. United Kingdom Milk Studies:

HASL-42, Atomic Energy Commission, "Environmental Contamination From Weapons Tests," Oct. 1958.

"Strontium-90 in Human Diet in the United Kingdom, 1958 Agricultural Research Council Radiobiological Laboratory Report No. 1, ARCRL-1."

MILK NETWORKS - SAMPLING STATION LOCATIONS

A. Public Health Service Milk Network Stations

- Atlanta, Georgia
- Austin, Texas
- Chicago, Illinois
- Cincinnati, Ohio
- Fargo, North Dakota - Moorhead, Minnesota
- New York, New York
- Overton, Nevada
- Sacramento, California
- Salt Lake City, Utah
- Spokane, Washington
- St. George, Utah
- St. Louis, Missouri

B. Health and Safety Laboratory, Atomic Energy Commission Milk Stations

- Perry, New York (Powdered Milk)
- New York City, New York (Liquid Milk)
- Mandan, North Dakota (Powdered Buttermilk for Animal Feed)

C. Los Alamos Scientific Laboratory, Atomic Energy Commission

(Same dried milk samples processed by Lamont Geological Observatory for Sr-90)

U. S. Stations

Aberdeen, Miss.
Albuquerque, N. Mex.
Andover, Mass.
Bertha, Minn.
Binghamton, New York
Bismarck, N. D.
Bottineau, N. D.
Burlington, Wash.
Chicago, Ill.
Claremont, Minn.
Columbus, Ga.
Deerfield, Wis.
Des Moines, Iowa
Elk City, Okla.
Ellensburg, Wash.
Fernbridge, Calif.
Fort Worth, Texas
Franklinton, La.
Fresno, Calif.
Glendale, Ariz.
Harrisonburg, Va.
Idaho Falls, Idaho
Lancaster, Pa.
Ladysmith, Wis.
LaGrange, Texas
Lansing, Mich.
Little Valley, N. Y.
Louisville, Ky.
Marietta, Ohio
McMinneville, Oreg.
Minonk, Ill.
Monroe, Utah
Newman, Calif.
New Orleans, La.
Norman, Okla.
Ogden, Utah
Payette, Idaho
Pittsburgh, Pa.
Springboro, Pa.
Sibley, Iowa
Springfield, Mo.
St. Albans, Vt.
Stillwater, Minn.
Sunnyside, Wash.
Tipton, Calif.
Wilkesboro, N. C.
Willows, Calif.

Foreign Stations

Buenos Aires, Argentina
Sydney, Australia
Belgium
Brazil
Calgary, Alb., Canada
Chesterville, Ont., Canada
Edmonton, Alb., Canada
Gananoque, Ont., Canada
Granby, Que., Canada
Jarvis, Ont., Canada
Kincardine, Ont., Canada
Saskatoon, Sask, Canada
St. Augustin, Que., Canada
Sussex, N. Bruns., Canada
Winnipeg, Manit., Canada
Santiago, Chile
Bogota, Colombia
Copenhagen, Denmark

Los Alamos Scientific Laboratory (Continued)

Middlesex, England
Paris, France
Frankfurt, Germany
Japan
Liberia
Mexico
Switzerland
Caracas, Venezuela

D. Minnesota Department of Health Milk Network

Brainerd
Duluth
Minneapolis
Rochester
Thief River Falls
Worthington

E. Lamont Geological Observatory Milk Sampling Network

(Same dried milk samples processed by Los Alamos for Cs-137)

U. S. Stations

Aberdeen, Miss.
Albuquerque, N. Mex.
Andover, Mass.
Bertha, Minn.
Binghamton, N.Y.
Bismarck, N.D.
Bottineau, N.D.
Burlington, Wash.
Chicago, Ill.
Claremont, Minn.
Columbus, Ga.
Deerfield, Wis.
Des Moines, Iowa
Elk City, Okla.
Ellensburg, Wash.
Fernbridge, Calif.
Fort Worth, Texas
Franklinton, La.
Fresno, Calif.
Glendale, Ariz.
Harrisonburg, Va.
Idaho Falls, Idaho
Lancaster, Pa.
Ladysmith, Wis.
LaGrange, Tex.
Lansing, Mich.
Little Valley, N.Y.
Louisville, Ky.
Marietta, Ohio
McMinneville, Ore.
Minonk, Ill.
Monroe, Utah
Newman, Calif.
New Orleans, La.
Norman, Okla.
Ogden, Utah
Payette, Idaho
Pittsburgh, Pa.
Springboro, Pa.
Sibley, Iowa
Springfield, Mo.
St. Albans, Vt.
Stillwater, Minn.
Sunnyside, Wash.
Tipton, Calif.
Wilkesboro, N.C.
Willows, Calif.

Lamont Geological Observatory Milk Sampling Network (Continued)

Foreign Stations

Buenos Aires, Argentina
Sydney, Australia
Belgium
Brazil
Calgary, Alb., Canada
Chesterville, Ont., Can.
Edmonton, Alb., Can.
Gananoque, Ont., Can.
Granby, Que., Can.
Jarvis, Ont., Can.
Kincardine, Ont., Canada
St. Augustine, Que., Can.
Saskatoon, Sask., Can.
Sussex, N. Bruns., Can.
Winnipeg, Manit., Can.
Santiago, Chile
Bogota, Colombia
Costa Rica
Copenhagen, Denmark
Middlesex, England
Paris, France
Frankfurt, Germany
Japan
Liberia
Mexico
South Africa
Switzerland
Caracas, Venezuela

F. Consumers Union - July - August 1958

U. S. Stations

Birmingham, Ala.
Los Angeles, Calif.
Washington, D. C.
Boise, Idaho
Des Moines, Iowa
New Orleans, La.
Sault Ste. Marie, Mich.
Jackson, Miss.
North Platte, Nebr.
Buffalo, N. Y.
Bismarck, N. D.
Portland, Ore.
Columbia, S. C.
Austin, Tex.
Norfolk, Va.
Spokane, Wash.
Juneau, Alaska
San Francisco, Calif.
Miami, Florida
Chicago, Ill.
Wichita, Kan.
Bangor, Maine
Duluth, Minn.
St. Louis, Mo.
Las Vegas, Nev.
New York, N. Y.
Cleveland, Ohio
Philadelphia, Pa.
Rapid City, S. D.
El Paso, Tex.
Seattle, Wash.
Charleston, W. Va.
Phoenix, Ariz.
Denver, Colo.
Atlanta, Ga.
Indianapolis, Ind.
Louisville, Ky.
Boston, Mass.

Consumers Union - July - August 1958 (Continued)

Minneapolis, Minn.
Great Falls, Mont.
Santa Fe, N. Mex.
Charlotte, N. C.
Tulsa, Okla.
Pittsburgh, Pa.
Memphis, Tenn.
Houston, Tex.
Salt Lake City, Utah
Casper, Wyoming

Foreign Stations

Quebec, Canada
Winnepeg, Canada

Consumers Union - July - August 1959

U. S. Stations

Little Rock, Arkansas
San Francisco, Cal.
Denver, Colorado
Durango, Colorado
Boise, Idaho
Chicago, Ill.
Springfield, Ill.
Des Moines, Iowa
Baton Rouge, La.
New Orleans, La.
Boston, Mass.
Duluth, Minn.
Minneapolis, Minn.
Jackson, Miss.
St. Louis, Mo.
Farmington, N. Mex.
New York, N. Y.
Bismarck, N. D.
Tulsa, Okla.
Pittsburgh, Pa.
Rapid City, S. D.
Memphis, Tenn.
El Paso, Tex.
Norfolk, Va.
Seattle, Wash.
Madison, Wisc.

Foreign Station

Quebec, Canada

G. Canadian Milk Stations

Vancouver	S	Winnipeg	B	Granby	S	Moncton	B
Edmonton	S	Walkerton	S	Megantic	S	Sussex	S
Calgary	S	London	S	La Durantye	S	East Florenceville	S
Saskatoon	B	Ottawa	S	Chicoutimi	S	Charlottetown	S

S = Skim Milk Powder
B = Buttermilk

H. United Kingdom Milk Network Districts

Cumberland & Westmorland

Northumberland Durham & Yorks
(North & East Riding)

Yorks (W. Riding)

Cheshire & Lancs

Staffs

Derby

Leics & Notts

Warwicks

Lincs

Norfolk & Suffolk

Beds, Cambs & Hunts

Northants

Hereford & Shropshire

Gloucester

Carms & Flamorgan

Brecknock, Merioneth & Mont

Anglesey, Caerns & Denbigh

Bucks & Oxon

Berks and Hants

Kent, Surrey & Sussex

Wilts

Dorset

Somerset

Cornwall

Devon

Orkney, Ross & Cromarty

Inverness & Moray

Aberdeen

Argyll, Ayr, Dunbarton,
Lanark, Renfrew & Stirling

Dumfries & Wigtown

Angus, Midlothian, Perth,
Roxburgh & Selkirk

Co. Antrim, Armagh, Down & Londonderry

Fermanagh & Tyrone

Essex & Herts

SECTION III

AIR

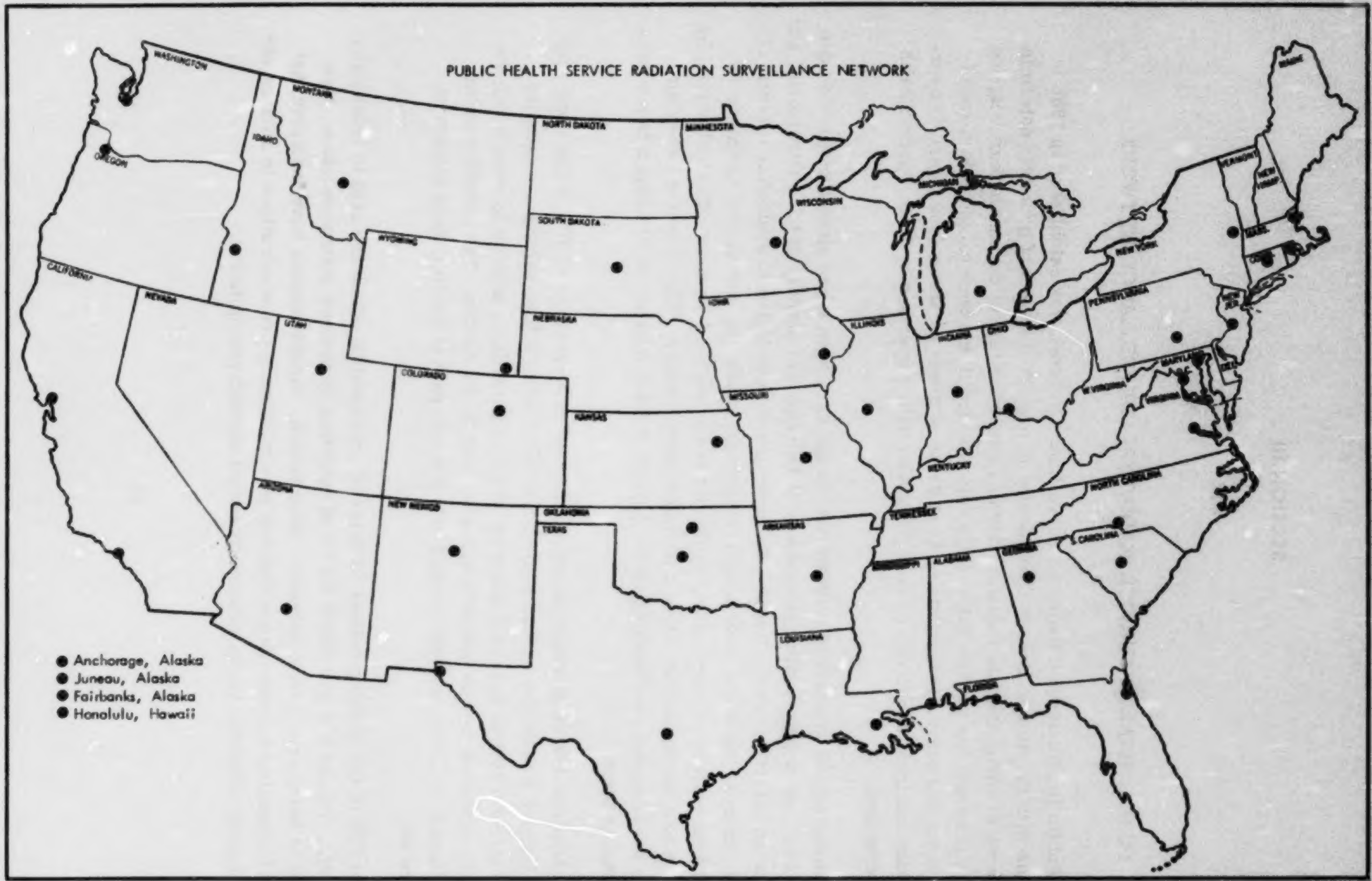
PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

The Public Health Service Radiation Surveillance Network was established in 1956 in cooperation with the Atomic Energy Commission to provide a means of promptly determining increases in environmental radiation due to radioactive fallout during nuclear weapons tests. The program has proven sufficiently valuable that it has been extended to a round-the-year basis and currently consists of 44 stations at urban locations (see figure 1) operated by State and local health department personnel with 3 operated by U. S. Public Health Service personnel.

Measurements of gross beta radioactivity in air have been taken since they provide one of the earliest and most sensitive indications of increases of activity in the environment, and thus act as an "alert" system. These data alone are not conducive to evaluation directly of biological hazards. However, field measurements do enable the operator to estimate the amount of beta activity of particulates in the air at the station five hours after collection, by comparison to a known source, using a portable survey meter. The filters are then forwarded to the laboratory in Washington for a more refined measurement using a thin window proportional counter.

Air samplers are in operation at the 44 stations on an average of 70% of the week. Air is drawn through a cellulose carbon loaded dust filter using a high volume air sampler. The radioactive material in fallout adhering to small dust-like particles is retained on the filter. Some gaseous fission products are adsorbed by the carbon. The contribution by gaseous fission products has represented only a small part of the total beta activity in these samples.

About 85% of the stations collect samples of precipitation which are sent to Washington for analysis. Values are now below limits of detection by present instrumentation. New equipment is being procured to measure lower values. Measurements have indicated that the bulk of deposited activity occurs through precipitation but concentrations in surface air are not directly relatable to the amount deposited through precipitation.


PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

● Anchorage, Alaska
● Juneau, Alaska
● Fairbanks, Alaska
● Honolulu, Hawaii
WASHINGTON
OREGON
CALIFORNIA
IDAHO
MONTANA
NEVADA
UTAH
WYOMING
COLORADO
ARIZONA
NEW MEXICO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
CAROLINA
NORTH CAROLINA
VIRGINIA
W VIRGINIA
PENNSYLVANIA
NEW YORK
MARYLAND
NEW JER
DEL
VERMONT
NEW HAMP
MAINE
MASS
CONN

AD-113

FIGURE 1

32<

External gamma measurements are also made at each station (see Section V).

More detailed data from this surveillance network are released monthly by the U. S. Public Health Service. A description of the program is printed in the Hearings on Radioactive Fallout held by the Joint Committee on Atomic Energy in May 1957, Vol. 1, page 459.

TABLE V. PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

Radioactivity of Particulates in Air
Micromicrocuries Per Cubic Meter - Gross Beta Counts
For Month of November 1959

Station Location	Weighted Average	Maximum	Minimum
Alaska, Anchorage	< 0.12	0.31	< 0.10
Alaska, Fairbanks	< 0.12	0.19	< 0.10
Alaska, Juneau	< 0.12	0.28	< 0.10
Arizona, Phoenix	< 0.16	0.23	< 0.10
Arkansas, Little Rock	< 0.12	0.20	< 0.10
California, Berkeley	< 0.18	0.24	< 0.10
California, Los Angeles	< 0.21	0.37	< 0.10
Colorado, Denver	< 0.18	0.29	< 0.10
Connecticut, Hartford	< 0.12	0.27	< 0.10
District of Columbia	< 0.14	0.56	< 0.10
Florida, Jacksonville	< 0.12	0.20	< 0.10
Georgia, Atlanta	< 0.14	0.21	< 0.10
Hawaii, Honolulu	< 0.11	0.17	< 0.10
Idaho, Boise	--	--	--
Illinois, Springfield	< 0.13	0.22	< 0.10
Indiana, Indianapolis	< 0.12	0.20	< 0.10
Iowa, Iowa City	< 0.11	0.20	< 0.10
Kansas, Topeka	< 0.11	0.19	< 0.10
Louisiana, New Orleans	< 0.15	0.19	< 0.10
Maryland, Baltimore	< 0.12	0.24	< 0.10
Massachusetts, Lawrence	< 0.10	0.23	< 0.10
Michigan, Lansing	< 0.11	0.19	< 0.10
Minnesota, Minneapolis	< 0.11	0.21	< 0.10
Mississippi, Pascagoula	< 0.29	0.71	< 0.10
Missouri, Jefferson City	< 0.13	0.24	< 0.10
Montana, Helena	< 0.12	0.16	< 0.10
New Jersey, Trenton	< 0.13	0.27	< 0.10
New Mexico, Santa Fe	< 0.16	0.27	< 0.10
New York, Albany	< 0.11	0.23	< 0.10
North Carolina, Gastonia	< 0.15	0.22	< 0.10
Ohio, Cincinnati*	0.49	2.80	0.20
Oklahoma, Oklahoma City	< 0.15	0.25	< 0.10
Oklahoma, Ponca City	< 0.10	0.13	< 0.10
Oregon, Portland	< 0.16	0.36	< 0.10
Pennsylvania, Harrisburg	< 0.15	0.26	< 0.10
Rhode Island, Providence	< 0.13	0.28	< 0.10
South Carolina, Columbia	< 0.12	0.20	< 0.10
South Dakota, Pierre	< 0.14	0.22	< 0.10
Texas, Austin	< 0.15	0.31	< 0.10
Texas, El Paso	< 0.24	0.68	< 0.10
Utah, Salt Lake City	< 0.17	0.42	< 0.10
Virginia, Richmond	< 0.12	0.19	< 0.10
Washington, Seattle	< 0.15	0.28	< 0.10
Wyoming, Cheyenne	< 0.13	0.18	< 0.10

*See explanation following next table.

TABLE VI. RADON AND THORON AIR MEASUREMENTS

November 2 - 30, 1959
Cincinnati, Ohio

RADIATION SURVEILLANCE NETWORK

(Beta Activity Included)

Date	Continuous Sample Collection			Beta[a] Activity μμc/m^3	Radon[b] AM μμc/m^3	Radon[c] PM μμc/m^3	Thoron[d] μμc/m^3
	Sample Change Time	Sampling Period (Hours)	Volume m^3				
Nov. 2	0804	71.8	73.7	0.4	200	62	2.5
3	0804	23.9	23.7	2.8	733	174	6.3
4	0804	23.9	26.5	0.7	176	72	1.3
5	0806	23.9	28.5	0.3	118	81	0.9
6	0804	23.8	28.1	0.2 (3)	86	92	0.7
9	0810	72.0	83.8	0.5	678	117	3.6
10	0804	23.8	26.3	0.5 (2)	362	122	2.8
11	0806	47.9	53.2	0.5	396	92	2.6
13	0804	23.9	27.3	0.2 (3)	224	93	2.2
16	0810	72.0	81.6	0.2	226	207	1.2
17	0804	23.9	28.5	0.3	135	76	0.8
18	0804	23.9	28.2	0.7	206	96	1.2
19	0804	23.9	28.8	0.7	252	188	1.8
20	0804	23.9	28.2	0.2 (3)	929	210	4.4
23	0804	71.9	83.3	0.8	253	118	4.9
24	0806	23.9	28.2	1.0	424	136	2.3
25	0804	23.8	28.0	0.0 (2)	70	42	0.6
27	0815	48.0	56.4	0.2 (3)	204	91	2.0
30	0804	72.8	85.1	0.2	143	101	1.1
Average				0.5	307	115	2.2

(a) Gross beta activity when counted one day after end of sampling or later as indicated by numeral in parenthesis.

(b) Radon from activity (alpha) of morning filter sample (uncorrected for thoron daughter interference). Measured within a few minutes of removal of filter from sampler and corrected to collection time.

(c) Radon from alpha in the afternoon (3 PM) test after seven hours of sampling.
NOTE: Values for PM Radon samples should be compared to the following day AM Radon samples.

(d) Thoron from alpha activity of filter sample counted 7 hours after taking a 24-96 hour sample.

It has been noted recently that values for beta activities in air in Cincinnati are somewhat higher than in other stations in the Radiation Surveillance Network. Reasons may be:

1. Cincinnati uses a membrane type filter with a 20 liters per minute flow rate, compared to a cellulose type filter at other stations sampling 1500 liters per minute.

2. Variations in counting equipment.

3. Samples are counted at Cincinnati within one day after collection, whereas the samples from other stations are counted several days later in Washington. Thus, Cincinnati values may incorporate natural beta activity from thoron daughters.

Although the relative contribution from each of these parameters has yet to be evaluated, it is recognized that some of them probably play a much more significant role than others.

U. S. NAVAL RESEARCH LABORATORY DATA ON RADIOACTIVITY IN AIR

Radioactivity measurements of air-filter samples collected at various sites along the 80th Meridian (west) are made by the U. S. Naval Research Laboratory under a program partially financed by the Atomic Energy Commission.

The daily record of fission product beta activity during November 1959 is shown in Table VII. The radioactivity profile for November 1959 is shown in Figure 2. All radioactivity concentrations are given in disintegrations per minute per cubic meter of air at the collecting site.

The low activity levels presently being encountered throughout this network necessitated that samples from several sites (Porto Alegre, San Juan and Columbia, S. C.) be omitted from radioactivity assay because of insufficient counting capacity.

TABLE VII. U. S. NAVAL RESEARCH LABORATORY DAILY RECORD OF FISSION PRODUCT β-ACTIVITY COLLECTED BY AIR FILTRATION

November 1959

	Disintegrations/minute per cubic meter of air					
Day	**Punta Arenas**	**Puerto Montt**	**Santiago**	**Antofagasta**	**Chacaltaya**	**Huancayo**
1	-	T	0.14	0.19	0.15	0.17
2	-	T	0.16	0.19	0.12	0.46
3	-	T	0.19	T	0.15	0.48
4	-	T	0.27	T	0.15	0.17
5	-	T	0.16	T	0.12	0.10
6	-	T	0.14	0.14	T	0.10
7	-	T	0.19	0.14	T	0.10
8	-	T	0.22	0.16	T	T
9	-	T	0.19	0.19	T	T
10	-	T	0.11	0.16	T	T
11	-	T	0.14	0.12	0.15	0.12
12	-	T	0.16	T	0.21	0.10
13	-	T	0.16	0.12	T	0.12
14	-	T	0.14	0.12	T	T
15	-	0.11	T	0.14	T	T
16	-	T	0.16	0.14	T	T
17	-	0.11	0.16	0.14*	0.15	0.15
18	-	T	0.16	0.14*	0.12	0.15
19	-	T	0.19	0.12*	0.15	0.15
20	-	T	0.16	0.12*	T	T
21	-	0.11	0.16	0.14*	T	T
22	-	T	0.24	0.14*	T	T
23	-	T	0.19	0.14*	T	T
24	-	T	-	0.18*	-	0.12
25	-	T	0.16	0.18*	-	0.17
26	-	T	0.16	0.15*	-	0.10
27	-	T	0.11	0.15*	-	T
28	-	T	0.14	-	T	T
29	-	T	0.11	-	T	T
30	-	T	0.16	-	T	0.22
Mean value	-	0.04	0.16	0.13	0.08	0.11

* denotes combined collections
- not received
T Trace

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TABLE VII. U. S. NAVAL RESEARCH LABORATORY DAILY RECORD OF FISSION PRODUCT β-ACTIVITY COLLECTED BY AIR FILTRATION
(Continued)

November 1959

Disintegrations/minute per cubic meter of air

Day	Lima	Iquitos	Guayaquil	Quito	Bogota	Miraflores
1	0.16	0.13	0.04*	T	T	T
2	0.16	T	0.04*	T	T	T
3	T	T	0.04*	T	T	0.36
4	0.21	T	T	T	T	T
5	0.16	T	0.11	T	T	T
6	0.13	T	0.11	T	T	T
7	0.11	T	T	T	T	T
8	T	T	0.06*	T	T	T
9	T	T	0.06*	T	T	T
10	0.13	T	T	T	T	T
11	T	T	T	T	T	T
12	T	T	T	T	T	T
13	T	T	T	T	T	T
14	T	T	T	T	0.48	T
15	T	T	T*	T	T	T
16	0.11	T	T*	T	T	T
17	0.11	T	T	T	T	0.11
18	T	-	T	T	T	0.14
19	0.13	-	T	T	T	T
20	T	T	T	T	T	T
21	0.11	T	T	-	T	T
22	0.13	-	0.07*	T	-	T
23	-	-	0.07*	-	-	T
24	-	-	T	T	T	T
25	-	-	0.11	T	T	T
26	-	-	0.13	T	T	T
27	-	0.24	0.13	T	T	0.11*
28	-	T	0.16	T	T	0.11*
29	0.17	-	0.12*	T	T	0.14
30	-	T	0.12*	T	T	0.14
Mean value	0.10	0.04	0.06	0.03	0.05	0.06

* denotes combined collections
- not received
T Trace

TABLE VII. U. S. NAVAL RESEARCH LABORATORY DAILY RECORD OF FISSION PRODUCT β-ACTIVITY COLLECTED BY AIR FILTRATION

(Continued)

November 1959

Disintegrations/minute per cubic meter of air

Day	Miami	Washington	Bedford	Moosonee	Coral Harbour	Thule
1	0.18	0.30	0.16	0.23	0.16	0.21
2	0.16	0.32	0.25	0.21	0.21	0.16
3	0.23	0.23	0.14	0.16	0.16	0.37
4	0.28	0.35	0.11	0.32	0.13	0.11
5	0.25	0.78	0.58	0.18	0.21	0.11
6	0.16	0.71	0.99	0.28	0.13	0.11
7	0.23	0.23	0.27*	0.21	0.13	0.23
8	0.18	0.23	0.27*	0.37	0.24	0.16
9	0.11	0.32	0.27*	0.35	0.24	0.32
10	0.39	0.41	0.21	0.21	0.16	0.28
11	0.39	0.35	0.27	0.32	0.16	0.35
12	0.11	0.41	0.30	0.23	0.24	-
13	0.11	0.39	0.35	0.14	0.24	0.30
14	0.11	0.39	0.28	0.21	0.29	0.39
15	0.16	0.14	0.18	0.30	0.40	0.28
16	0.21	0.30	0.32	0.35	0.32	0.37
17	T	0.21	0.09	0.23	0.27	-
18	0.11	0.44	0.18	0.30	0.37	0.35
19	T	0.46	0.23	0.35	0.24	0.39
20	0.32	T	0.37	0.37	T	-
21	0.37	0.35	0.28	0.28	0.13	0.41
22	T	0.37	0.23	0.25	0.29	0.64
23	0.09	0.37	0.21	0.23	0.16	0.81
24	0.09	0.48	0.39	0.18	0.11	0.74
25	0.16	0.18	0.23	0.25	0.16	-
26	0.62	0.24*	0.28	T	0.17	-
27	1.06	0.24*	0.21	0.14	0.16	0.41
28	0.55	0.41	0.41	0.14	0.16	0.58
29	0.30	0.16	0.09	0.14	0.21	0.53
30	0.37	0.21	0.16	0.23	0.17	0.21
Mean value	0.25	0.33	0.28	0.24	0.20	0.35

* denotes combined collections
- not received
T Trace

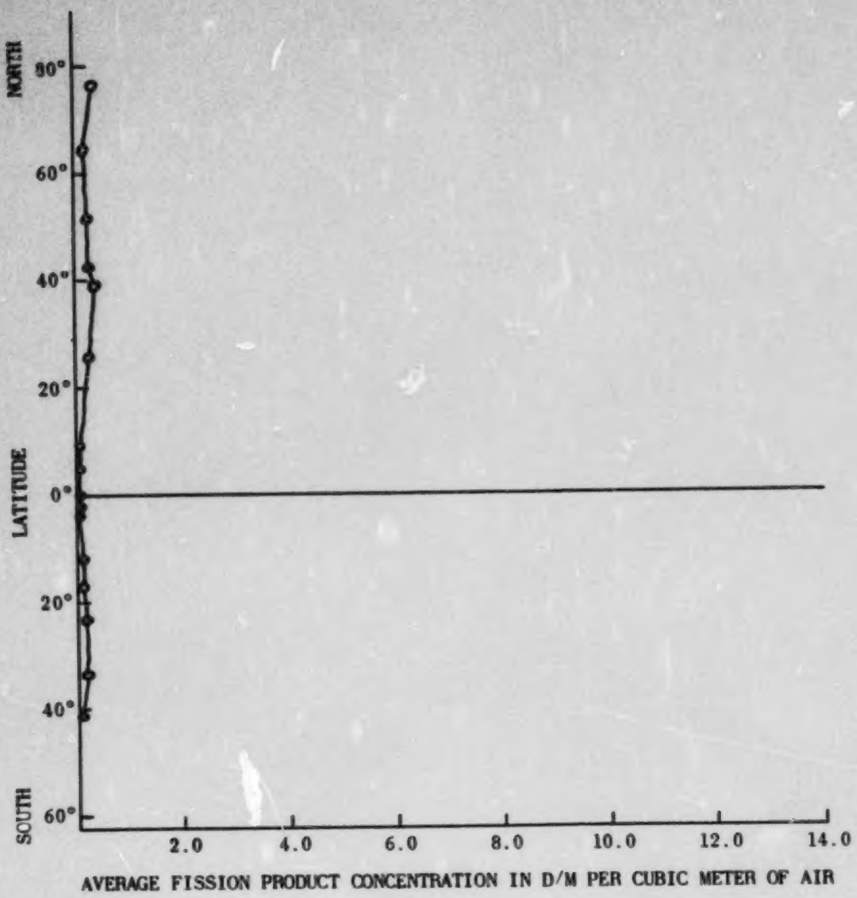

FIGURE 2

RADIOACTIVITY PROFILE FOR NOVEMBER 1959

SECTION IV

WATER

PUBLIC HEALTH SERVICE
NATIONAL WATER QUALITY NETWORK

The National Water Quality Network was established under the provisions of Section 4(c) of Public Law 660, which states that "... the Surgeon General shall ... collect and disseminate basic data ... (relating) to water pollution and the prevention and control thereof."

This Network, operated in cooperation with State and local health agencies, was started in October 1957. At present there are 61 sampling stations located on major waterways used for public water supply, propagation of fish and wildlife, recreational purposes, and for agricultural, industrial and other uses; some of these stations are interstate, coastal, and International Boundary waters, and waters on which activities of the Federal Government may have an impact. Ultimately a total of 250 to 300 stations will be operated. A few of the more recently established stations have not yet begun to report radioactivity.

Samples of water are examined for chemical, physical, and biological quality insofar as these relate to pollution. Samples for some determinations are taken weekly, others monthly, and for some continuous composite samples of 10 to 15 days are obtained. Radioactivity determinations are made on single samples, taken weekly.

Gross alpha and beta measurements are made on both suspended and dissolved solids in the raw surface water samples. The radioactivity levels of dissolved solids provide a rough measure of the levels which may be found in a treated water, where such water treatment removes substantially all of the suspended matter. Naturally occurring radioactive substances in the environment are the source of essentially all of the alpha activity. The contamination of the environment from man-made sources is the major contributor to the beta activity. The results are reported in micromicrocuries per liter, and are shown for each station on a given river.

While beta determinations for the first two years of the Network operation have been done on each sample weekly, the alpha determinations are reported generally on a composite sample of more than one week. Beginning with samples taken in January 1960, beta determinations are to be performed on composite samples obtained by combining two weekly samples. The alpha data will be reported on three-month composite samples, with 1/3 of

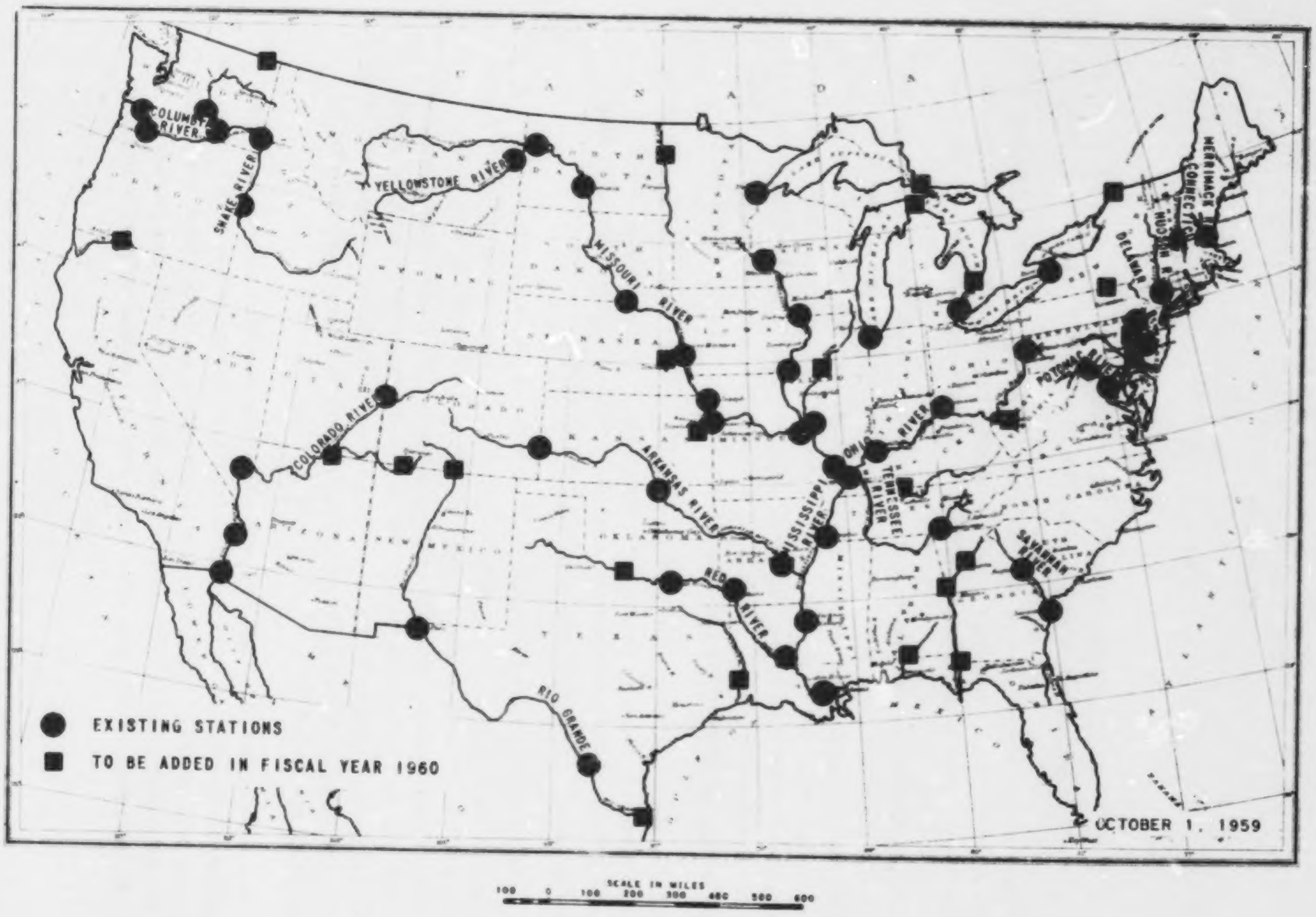
COLUMBIA RIVER
SNAKE RIVER
YELLOWSTONE RIVER
MISSOURI RIVER
COLORADO RIVER
ARKANSAS RIVER
RED RIVER
RIO GRANDE
MISSISSIPPI RIVER
OHIO RIVER
TENNESSEE RIVER
SAVANNAH RIVER
POTOMAC RIVER
DELAWARE
HUDSON R.
CONNECTICUT
MERRIMACK
CANADA
WYOMING
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
ARIZONA
NEW MEXICO
EXISTING STATIONS
TO BE ADDED IN FISCAL YEAR 1960
OCTOBER 1, 1959
SCALE IN MILES
100 0 100 200 300 400 500 600

FIGURE 3

PHS WATER QUALITY BASIC DATA PROGRAM NETWORK OF SAMPLING STATIONS

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the stations being covered each month. All the data reported below represent the average of all information available for the month indicated.

Strontium-90 data are reported as being the results of determinations on composite sample for a three-month period ending in the month shown.

Additional information and data may be obtained from the following sources:

1. "National Water Quality Network Annual Compilation of Data," PHS Publication. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price $1.50.

2. "Report on National Water Quality Control Network," submitted by Dr. F. J. Weber, Chief, Division of Radiological Health, PHS, to Joint Committee on Atomic Energy Hearings on Fallout from Nuclear Weapons Tests, Vol. 1, May 1959, Pages 167-169.

TABLE VIII. PUBLIC HEALTH SERVICE NATIONAL WATER QUALITY NETWORK RADIOACTIVITY IN RAW SURFACE WATERS

(Micromicrocuries per liter)

Station	Quarter ending Sept. 30, 1959	Month of October 1959 (Average to nearest whole number)					
	Strontium-90	Beta Activity			Alpha Activity		
		Susp.	Dis.	Tot.	Susp.	Dis.	Tot.
ALSEA RIVER							
Alsea, Ore.	0.2	<1	1	2	0	0	0
ARKANSAS RIVER							
Coolidge, Kans.	1.4	<1	19	19	4	30	34
Ponca City, Okla.	0.5	18	20	38	18	1	19
Fort Smith, Ark.	2.1	98	8	106	19	0	19
Pendleton Ferry, Ark.	0.3	86	9	95	30	0	30
CHATTAHOOCHIE RIVER							
Columbus, Ga.	-	<1	5	5	0	0	0
COLORADO RIVER							
Loma, Colo.	0.3	14	16	30	8	4	12
Hoover Dam, Ariz.-Nev.	0.9	4	30	34	<1	8	9
Parker Dam, Ariz.-Calif.	0.6	0	6	6	0	6	6
Yuma, Ariz.	0.8	<1	2	2	<1	5	6
COLUMBIA RIVER							
Wenatchee, Wash.	0.4	1	4	4	0	0	0
Pasco, Wash.	1.0	25	445	470	0	0	0
Bonneville Dam, Ore.	0.5	22	280	302	0	0	0
Clatskanie, Ore.	0.5	15	139	154	0	1	1

TABLE VIII. PUBLIC HEALTH SERVICE NATIONAL WATER QUALITY NETWORK RADIOACTIVITY IN RAW SURFACE WATERS

(Micromicrocuries per liter)
(Continued)

Station	Quarter ending Sept. 30, 1959	Month of October 1959 (Average to nearest whole number)					
	Strontium-90	Beta Activity			Alpha Activity		
		Susp.	Dis.	Tot.	Susp.	Dis.	Tot.
CONNECTICUT RIVER							
Northfield, Mass.	1.9	-	-	-	-	-	-
DELAWARE RIVER							
Philadelphia, Pa.	0.6	4	4	8	0	0	0
GREAT LAKES							
Gary, Ind.	0.4	3	2	5	0	1	1
Duluth, Minn.	0.2	1	4	5	0	1	1
Detroit, Mich.	0.6	4	3	7	0	0	0
Buffalo, N. Y.	0.8	28	1	29	0	1	1
HUDSON RIVER							
Poughkeepsie, N. Y.	1.0	<1	6	7	0	1	1
MERRIMACK RIVER							
Lowell, Mass.	1.2	15	6	21	-	-	-
MISSISSIPPI RIVER							
Red Wing, Minn.	0.5	2	2	4	0	2	2
Dubuque, Iowa	1.6	<1	11	11	-	-	-
Burlington, Iowa	1.1	17	9	26	2	2	4
East St. Louis, Ill.	1.2	5	2	7	16	2	18
Cape Girardeau, Mo.	1.2	39	7	46	16	4	20
West Memphis, Ark.	1.3	17	10	27	-	-	-
Delta, La.	1.3	36	6	42	7	0	7
New Orleans, La.	1.0	5	9	14	13	1	14
MISSOURI RIVER							
Williston, N. D.	0.5	6	2	8	2	4	6
Bismarck, N. D.	0.8	26	7	33	19	4	23
Yankton, S. D.	0.4	2	8	10	-	-	-
Omaha, Nebr.	1.1	12	22	34	4	4	8
St. Joseph, Mo.	0.6	26	5	31	7	3	10
Kansas City, Kans.	0.3	15	14	29	6	11	17
St. Louis, Mo.	0.5	26	10	36	12	2	14
OHIO RIVER							
East Liverpool, O.	1.2	6	10	16	0	0	0
Huntington, W. Va.	1.0	8	18	26	1	1	2
Cincinnati, O.	0.9	0	<1	<1	0	0	0
Evansville, Ind.	2.0	-	-	-	-	-	-
Cairo, Ill.	1.2	1	6	7	0	1	1

TABLE VIII. PUBLIC HEALTH SERVICE NATIONAL WATER QUALITY NETWORK RADIOACTIVITY IN RAW SURFACE WATERS

(Micromicrocuries per liter)
(Continued)

Station	Quarter ending Sept. 30, 1959	Month of October 1959 (Average to nearest whole number)					
	Strontium-90	Beta Activity			Alpha Activity		
		Susp.	Dis.	Tot.	Susp.	Dis.	Tot.
POTOMAC RIVER							
Williamsport, Md.	0.7	4	7	11	0	1	1
Great Falls, Md.	0.8	1	5	6	0	0	0
RED RIVER							
Denison, Tex.	1.0	3	4	7	0	3	3
Index, Ark.	0.6	14	2	16	1	7	8
Alexandria, La.	0.4	30	0	30	7	0	7
RIO GRANDE RIVER							
El Paso, Tex.	0.3	0	10	10	-	-	-
Laredo, Tex.	0.2	67	3	70	0	1	1
Brownsville, Tex.	-	6	35	41	2	9	11
SAVANNAH RIVER							
North Augusta, S. C.	0.3	2	5	7	-	-	-
Port Wentworth, Ga.	0.7	20	12	32	0	0	0
SNAKE RIVER							
Wawawai, Wash.	0.4	3	10	13	0	1	1
TENNESSEE RIVER							
Chattanooga, Tenn.	3.8	3	5	8	0	0	0
YELLOWSTONE RIVER							
Sidney, Mont.	0.7	14	10	24	0	0	0

MONITORING OF WATER SUPPLIES AROUND THE NEVADA TEST SITE

By contract with the Atomic Energy Commission the U. S. Public Health Service has conducted an off-site monitoring program around the Nevada Test Site for several years. Included in the program have been measurements of radioactivity in water supplies. These data have been reported in the Atomic Energy Commission's 13th, 14th, 18th and 23rd Semiannual Reports to Congress and by the Public Health Service in the 1957 Congressional Hearings, "The Nature of Radioactive Fallout and Its Effects on Man."

The map following summarizes the data on radioactivity (gross beta) in water supplies for the months of November and December 1959. The lower limit of detectability with the equipment used is about 10^{-8} microcuries per milliliter (10 micromicrocuries per liter).

HEALTH AND SAFETY LABORATORY - ATOMIC ENERGY COMMISSION STRONTIUM-90 IN NEW YORK CITY TAP WATER

New York City tap water is monitored for strontium-90 on a monthly basis by the Atomic Energy Commission's New York Health and Safety Laboratory. The strontium-90 in tap water for September 1959 is presented below. Data for other months in 1959 were given in HASL-77, p. 68.*

HASL #	Total volume collected liters	$\mu\mu c$ Sr^{90}/liter	Sr^{89}/Sr^{90} a midpoint of sampling month
11363	225	0.78 ± 0.01	0.8

STATE OF MINNESOTA WATER DATA

The following is reproduced from Radiation Surveillance Studies (Summary report for the period October 1957 to August 1959) by the Minnesota Department of Health, Division of Environmental Sanitation. Other states are invited to transmit similar summarized data for possible inclusion in these monthly and quarterly reports.

"Activity in Ground and Surface Water

The analysis of various Minnesota waters for radioactivity concentrations was initiated late in 1956, as part of the Minnesota Water Pollution Control Program.

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*Health and Safety Laboratory Strontium Program Quarterly Summary Report, January 1, 1960, available from the Office of Technical Services, Department of Commerce, Washington 25, D.C., for $3.50.

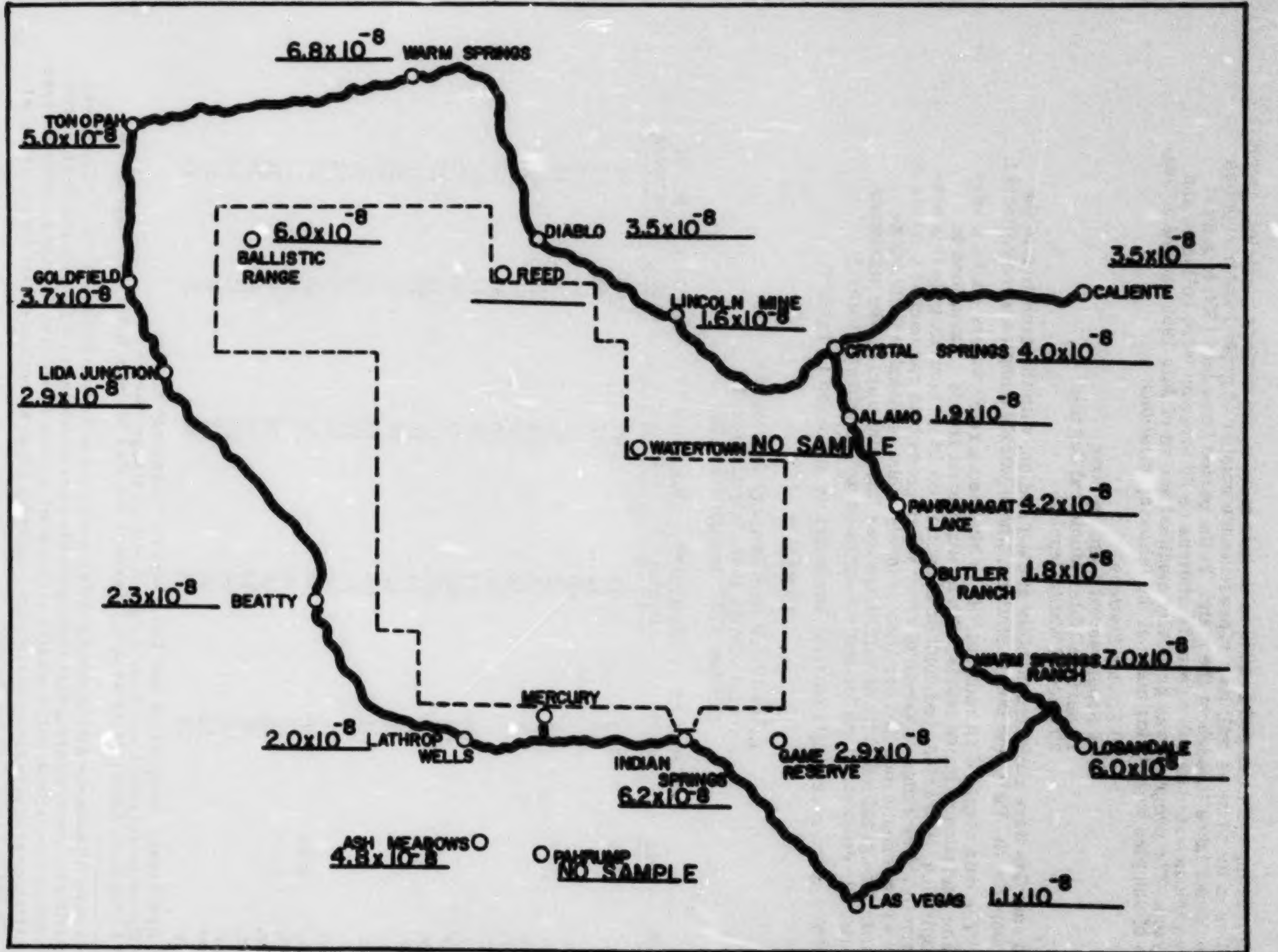
6.8x10^{-8}
WARM SPRINGS
TONOPAH
5.0x10^{-8}
6.0x10^{-8}
BALLISTIC RANGE
DIABLO
3.5x10^{-8}
REED
3.5x10^{-8}
CALIENTE
GOLDFIELD
3.7x10^{-8}
LINCOLN MINE
1.6x10^{-8}
CRYSTAL SPRINGS
4.0x10^{-8}
LIDA JUNCTION
2.9x10^{-8}
ALAMO
1.9x10^{-8}
WATERTOWN
NO SAMPLE
PAHRANAGAT LAKE
4.2x10^{-8}
2.3x10^{-8}
BEATTY
BUTLER RANCH
1.8x10^{-8}
WARM SPRINGS RANCH
7.0x10^{-8}
MERCURY
2.0x10^{-8}
LATHROP WELLS
INDIAN SPRINGS
6.2x10^{-8}
GAME RESERVE
2.9x10^{-8}
LOGANDALE
6.0x10^{-8}
ASH MEADOWS
4.8x10^{-8}
PAHRUMP
NO SAMPLE
LAS VEGAS
1.1x10^{-8}

FIGURE 4

GROSS BETA MEASUREMENTS IN WATER SUPPLIES IN OFF-SITE AREAS OF THE NEVADA TEST SITE FOR NOVEMBER-DECEMBER 1959 (μc/ml at count time)

This program was expanded in 1958 to include most of the surface municipal water supplies in the state as well as a representative number of ground water supplies and selected lakes throughout the state. In the period from late 1956 to August 1959, various water samples from 74 stations on 25 streams were collected and analyzed. The program was gradually modified and as of July 1959 routine collections of samples were being made at the following locations:

20 Stream Stations
8 Supplemental Lake Stations
16 Surface Water Municipal Supplies
20 Ground Water Supplies

Grab samples were collected monthly at each station, with the exception of the Minneapolis, St. Paul, and Duluth stations, where weekly samples were collected.

"The data obtained on radioactivity in Minnesota river waters shows a very random variation of gross levels, with no significant trends. Variations in precipitation, flow rates, and point of collection could all contribute to this non-uniformity. The range of values of river water gross beta radioactivity levels is from 431 micromicrocuries per liter to levels indistinguishable from background. The great majority of values are less than 100 $\mu\mu c/l.$, the maximum permissible concentrations for water consumed on a continuous basis.*

"The more recent data on river water are summarized in Table V.

TABLE V

River Water Radioactivity Summary
Average Gross Beta Activity $\mu\mu c/L.$
October 1957 through July 1959

Month	Year	Northern* Region	Central** Region	Southern*** Region	Entire State	No. of Samples
Oct.	1957	169	62	67	99	37
Nov.		45	34	35	40	34
Dec.			25	26	26	46
Jan.	1958	25	16	22	21	48
Feb.			15	34	24	15
Mar.		77	42	38	52	27
Apr.			27	50	38	44
May		68	34	38	47	21
June		68	48	63	60	33
July		138	145	75	116	23
Aug.		60	99	75	78	20
Sept.		59	45	48	51	23
Oct.		51	60	72	61	37
Nov.		68	97	69	78	30
Dec.		74	36	39	50	24
Jan.	1959	28	34	26	29	22
Feb.		39	16	25	27	29
Mar.		36	16	59	40	31
Apr.		57	30	54	48	29
May		60	50	29	67	26
June		52	36	51	47	31
July		36	31	34	32	19

* Red River, Rainy River and Lake Superior Drainage Basins
** Upper Mississippi and Saint Croix River Drainage Basins
*** Minnesota, Lower Mississippi, Missouri and Des Moines River Drainage Basins

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* Editor's note: Please see discussion on "Interpretations of Radiation Levels," p. 1. The gross beta activities in waters during these time periods were essentially all from mixed fission products in radioactive fallout, only a small fraction of which was strontium-90. Other radioisotopes in mixed fission products are relatively less hazardous than strontium-90 and thus have higher maximum permissible concentrations.

"As pointed out above, samples have been collected routinely at 16 municipal surface water supplies. Samples of the raw water and the treated water were collected at each of these points and analyzed for gross beta activity. Data from this program are available on samples collected up to August 1, 1959. The levels in the raw-water samples through the data range from levels indistinguishable from background to 222 micromicrocuries per liter, with an average value of 41 $\mu\mu c/l$. The levels found on the treated water ranged from those indistinguishable from background to 130 $\mu\mu c/l.$, with an average value of 20 $\mu\mu c/l$. These figures would indicate that water treatment plants have removed, on the average, a little more than 50 percent of the radioactivity from raw water. The efficiency of removal varies widely, depending on the age of the fission products and the type of treatment involved.

"A routine collection of samples from 8 of the major lake types in Minnesota was initiated in 1958. Monthly grab samples were collected and analyzed for gross beta radioactivity. Levels found through 1959 ranged from those indistinguishable from background to 286 micromicrocuries per liter. The average value is 30 micromicrocuries per liter.

"Samples have been collected from 20 municipal well water supplies. The wells were selected to give a good cross section of the levels of activity which exist in the water supplies in the various geological formations which serve as water sources to some part of the Minnesota population. Samples were collected from wells drawing water from river deposits, glacial draft deposits, springs, deep sedimentary rock, Sioux quartzite, and mine drainage. The levels of beta activity ranged from levels indistinguishable from background to 170 micromicrocuries per liter and the average value was 16 micromicrocuries per liter. The levels of alpha activity ranged from those indistinguishable from background to 110 micromicrocuries per liter, and the average value was 8 micromicrocuries per liter. Tables VI through IX include the complete data on these four sampling programs.*

"It is somewhat difficult to ascertain any meaningful trends in these data, beyond a general conclusion that the levels in all surface water samples have been generally decreasing in the last several months. This is undoubtedly due to the cessation of weapons testing by all the nuclear powers. There does not appear to be real cause for concern at present over the levels of radioactivity in municipal drinking water supplies.

"Although the threat of contamination from weapons fallout appears to be diminishing, the expected rise in the use of reactors for power in the future may present problems very similar to those of fallout. The experience gained during the operation of the large water sampling program will be invaluable in meeting these problems."

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* Editor's note: Because of their length, Tables VI through IX are not included here. Please refer to the basic document.

SECTION V

OTHER DATA

EXTERNAL GAMMA ACTIVITY
PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

Portable survey instruments are available at the stations of the Radiation Surveillance Network and one of their uses is to record external gamma radiation. These readings are not precise, especially for measurement of low levels but they can show the presence or absence of any significant increases above background. The differences among the values shown on the following table are within the variances anticipated due to differences in normal background and in instrument response characteristics.

TABLE IX. EXTERNAL GAMMA ACTIVITY
PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK
Milliroentgens Per Hour - at three feet above the ground
For Month of November 1959

Station Location	Average
Alaska, Anchorage	0.011
Alaska, Fairbanks	0.010
Alaska, Juneau	0.015
Arizona, Phoenix	0.012
Arkansas, Little Rock	0.020
California, Berkeley	0.010
California, Los Angeles	0.012
Colorado, Denver	0.020
Connecticut, Hartford	0.013
District of Columbia	0.020
Florida, Jacksonville	0.020
Georgia, Atlanta	0.020
Hawaii, Honolulu	0.025
Idaho, Boise	*
Illinois, Springfield	*
Indiana, Indianapolis	0.011
Iowa, Iowa City	0.013
Kansas, Topeka	0.020
Louisiana, New Orleans	0.011
Maryland, Baltimore	0.015
Massachusetts, Lawrence	0.015
Michigan, Lansing	0.020
Minnesota, Minneapolis	0.020
Mississippi, Pascagoula	*
Missouri, Jefferson City	0.010
Montana, Helena	0.024
New Jersey, Trenton	0.020
New Mexico, Santa Fe	0.030
New York, Albany	0.020
North Carolina, Gastonia	0.020
Ohio, Cincinnati	*
Oklahoma, Oklahoma City	0.020
Oklahoma, Ponca City	0.040
Oregon, Portland	0.019
Pennsylvania, Harrisburg	*
Rhode Island, Providence	0.019
South Carolina, Columbia	0.018
South Dakota, Pierre	0.020
Texas, Austin	0.010
Texas, El Paso	0.019
Utah, Salt Lake City	0.015
Virginia, Richmond	0.010
Washington, Seattle	0.015
Wyoming, Cheyenne	0.020

*No data received this month.

TABLE X. FISSION PRODUCT RADIOACTIVITY IN SOIL AT ARGONNE NATIONAL LABORATORY - ATOMIC ENERGY COMMISSION

(In millicuries per square mile*)

Isotope	1959			
	August	September	October	November
Zr^{95}-Nb^{95}	592	444	366	264
Cs^{137}	159	172	201	186
Ru^{106} (1 y)	855	1003	969	996
Ru^{103} (40 d)	53	30	--	--
Ce^{141} (32 d)	74	48	--	--
Ce^{144} (290 d)	1706	1774	1924	1846
Totals	4031	3915	3826	3556
Dose (urad/hr)**	5.33	4.49	4.00	3.33

* Reported to the Atomic Energy Commission by Dr. Philip F. Gustafson, Argonne National Laboratory.

** Editor's note: These calculated values are based on the theoretical considerations that if all of these radioisotopes found in depth within the soil were placed in an infinitely flat plane, then the indicated dose rates would result at a height of three feet above that plane.

MINNESOTA DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL SANITATION
RADIATION SURVEILLANCE STUDIES

From Summary Report for the Period October 1957 to August 1959

"Activity in Fish

"In February, 1958 at the request of the Department of Conservation, a study of the levels of radioactivity in game fish was initiated jointly by the Department of Health and the Division of Game and Fish Department of Conservation. Four Minnesota fisheries stations were selected to collect the samples on a monthly basis. Samples were shipped to the Health Department Laboratories for analysis. Initially the level of gross beta radioactivity only was determined, but when equipment and satisfactory methods were available, the samples were also analyzed for strontium-90.

"In the period from February, 1958 through July, 1959, 31 samples were analyzed for strontium-90. The average level in these samples was 131 $\mu\mu c$ Sr-90/kg, which is above the generally used maximum permissible concentration of 100 $\mu\mu c$ Sr-90/kg for foodstuffs.* Six of these samples were divided into waste, bones, skin, and flesh, and these four parts were analyzed individually. In four of the fish specimens, the average concentration in all flesh, or edible portions, was 12 $\mu\mu c$ Sr-90/kg, or slightly more than 10 percent of the recommended maximum permissible level. Two of the flesh samples were not run due to error in method made during the early phase of the study.

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* Editor's note: Please see discussion on "Interpretation of Radiation Levels," page 1.

"The complete details of the study are contained in a report from the Department of Health to the Department of Conservation titled, Levels of Strontium-90 in Minnesota Fish. The report draws the following conclusion from the study, 'The results of this study indicate that in the light of present knowledge no immediate health hazard from the effects of strontium-90 exists from the consumption of Minnesota fish.' "

URANIUM MILL DISCHARGES

The problem of radioactive pollution of the Animas River (Colorado-New Mexico) from the discharge of a uranium mill was surveyed in 1958. The following agencies cooperated with the U. S. Public Health Service in this study:

U. S. Atomic Energy Commission
State of Colorado Department of Public Health
New Mexico Department of Public Health
State of Colorado Department of Game and Fish
San Juan Basin Health Unit, Durango, Colorado
San Juan County Health Department, Farmington, New Mexico
U. S. Geological Survey
Vanadium Corporation of America

The survey included a wide variety of environmental samples such as river waters, treated water supplies, local milk and food, and effluents from the uranium ore refineries. Radium and uranium content of the samples were measured, as well as the gross alpha and beta activities. Many chemical analyses were also performed.

The table below indicates the radium content in water supplies before (1958) corrective actions were taken by the mill and afterwards (1959). In addition, the irrigation waters used to raise crops locally have also improved proportionately in terms of their radium content, and thus lower radium concentrations in crops are anticipated. Based upon further actions now being taken by the mill, it is estimated that the dissolved radium content of these water supplies will be routinely no greater than 1.00 micromicrocuries per liter.

TABLE XI. RADIUM CONTENT OF WATER SUPPLIES

Station and Item	Dissolved Radium, $\mu\mu$c/liter		
	1958	1959	Approximate % Decrease
Aztec, New Mexico			
Raw Water	3.4	1.4	60
Treated Water	3.6*	1.15	68
Farmington, New Mexico			
Raw Water	2.8	1.25	56
Treated Water	2.6	1.40	46

* Residual contamination of the filter sands in the treatment plants resulted in a higher level of dissolved radium for treated water than for raw river waters.

REFERENCES

1. Survey of Interstate Pollution of the Animas River, Colorado-New Mexicc, Tsivoglou, E. C., Shearer, S. D., Shaw, R. M., Jr., Jones, J. D., Anderson, J. B., Sponagle, C. E., and Clark, D. A. U. S. Public Health Service report, May 1959.

2. Survey Interstate Pollution of the Animas River, Colorado-New Mexico, II 1959 Surveys. Tsivoglou, E. C., Shearer, S. D., Jones, J. D., Sponagle, C. E., Pahren, H. R., Anderson, J. B., and Clark, D. A. U. S. Public Health Service report, January 1960.

RADIOLOGICAL HEALTH DATA

MONTHLY REPORT

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Division of Radiological Health

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PREFACE

In August 1959, the President directed the Secretary of Health, Education, and Welfare to intensify Departmental activities in the field of radiological health. The Department was assigned, among other things, primary responsibility within the Executive Branch for the collation, analysis, and interpretation of data on environmental radiation levels. Within the Department this responsibility has been delegated to the Division of Radiological Health, Public Health Service.

As a step in the discharge of this responsibility, the Public Health Service is issuing this monthly publication. The data have been submitted by agencies of the Federal government, by States, and by other sources. Each third report, starting July 1960, will contain interpretive statements as well as data.

The monthly and quarterly reports will be reviewed by a Board of Editorial Advisors with representatives from the following Federal agencies:

Department of Health, Education, and Welfare
Atomic Energy Commission
Department of Defense
Department of Commerce
Department of Agriculture

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SECTION I

MILK

PUBLIC HEALTH SERVICE MILK MONITORING PROGRAM

The Public Health Service Milk Monitoring Network presently consists of 12 sampling stations. This will be expanded to about 60 stations by the summer of 1960.

The initial purpose of establishing this network was in keeping with the normal and continuing program of the U.S. Department of Health, Education, and Welfare to determine trends in our changing environment, including measurement of amounts of radioactivity in water, air, milk, and other foods. Milk was the food chosen for initial testing since it is among the most important elements of the diet and is constantly available at all seasons of the year and in all climates. A primary objective of the project was to develop and simplify methods of collection and radiochemical analysis of milk to make them more suitable for larger scale programs.

The selection of the present 12 sampling stations was based on the following criteria:

1. The milk represented in each sample was from a group of farms milking a total of at least 1,000 cows.
2. The number of individual farms was small enough so that collection of collateral field data from each farm was feasible.
3. The milk samples were from a supply that was part of a metropolitan milkshed.
4. The conditions under which the milk was received were such that each sample was representative of the same farms in the production area.

The Overton, Nevada and St. George, Utah milksheds do not fulfill the 1,000 cow minimum requirement but have been included since they are part of the monitoring program around the Nevada Test Site.

One gallon samples are collected once each month and forwarded by air parcel post to the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, for radionuclide analysis. It is estimated that these samples represent 2,000 gallon lots. The concentration of iodine-131, barium-140, and cesium-137 and naturally occurring potassium-40 are all currently being measured when present in the milk by gamma scintillation spectroscopy. Total strontium and strontium-90 are determined following radiochemical separations, and the strontium-90 is calculated by measuring the build-up of the daughter decay product, yttrium-90 (after about a two week wait) using a low background anticoincidence beta counter. The total radioactive strontium is counted in a shielded internal proportional counter with the strontium-89 calculated as the difference.

Publication of the data will normally require a period of about three months after collection due to shipment, processing, decay product build-up, compilation of the data, and inclusion with other radiation data in the monthly reports.

A description of the program appears in "The Occurrence of Strontium-90, Iodine-131 and Other Radionuclides in Milk, May 1957 through April 1958," by J. E. Campbell, G. K. Murthy, A. S. Goldin, H. B. Robinson, C. P. Straub, F. J. Weber, and K. H. Lewis, American Journal of Public Health, Vol. 49, No. 2, February 1959, American Public Health Association, reprinted by the Joint Committee on Atomic Energy Hearings on Fallout from Nuclear Weapons Tests, Vol. 1, May 1959.

Detailed technical descriptions of the methodology of analyses are listed below:

"Determination of I-131, Cs-137 and Ba-140 in Fluid Milk by Gamma Spectroscopy." By G. R. Hagee, G. R. Karches and A. S. Goldin, Public Health Service.

"A Method for the Rapid Ashing of Milk for Radionuclide Analysis," Journal of Dairy Science, 42-1288, Aug. 1959. By G. K. Murthy, J. E. Campbell.

"A Method for the Determination of Radionuclides in Milk Ash," Journal of Dairy Science, 14 1276, Aug. 1959. By G. K. Murthy, L. P. Jarnagin, and A. S. Goldin.

"A Method for the Elimination of Ashing in Strontium-90 Determination of Milk," Journal of Dairy Science, 43 (2) 151, Feb. 1960. By. G. K. Murthy, J. E. Coakley and J. E. Campbell.

TABLE 1—PUBLIC HEALTH SERVICE DATA ON RADIOACTIVITY IN MILK

December 1959

Data from one sampling point supplying the cities listed below

Radioactivity in $\mu\mu c$/liter

Area	Calcium grams/liter		Iodine-131		Strontium-89		Strontium-90		Barium-140		Cesium-137	
	Dec.	Yearly average	Dec.	Yearly average	Dec.	Yearly average	Dec.	Yearly average	Dec.	Yearly average	Dec.	Yearly average
Atlanta, Ga.	1.18	1.18	(a) 0	3	5	46	14	15	0	<1	70	86
Austin, Tex.	1.16	1.13	0	2	0	23	7	6	0	<1	20	46
Chicago, Ill.	1.12	1.10	0	2	0	11	8	9	0	0	35	56
Cincinnati, Ohio	1.16	1.13	0	1	0	18	14	13	0	<1	35	49
Fargo, N. Dak. Moorhead, Minn.	1.14	1.12	0	2	0	16	16	14	0	<1	70	61
New York, N. Y.	1.08	1.08	0	2	0	9	9	9	0	<1	40	53
Overton, Nev. (b)	1.16	1.07	0	<1	0	2	3	3	0	0	20	30
Sacramento, Calif.	1.16	1.11	0	1	0	14	4	5	0	<1	10	44
Salt Lake City, Utah	1.15	1.12	0	2	0	8	6	7	0	<1	35	43
Spokane, Wash.	1.16	1.17	0	4	0	21	13	12	0	<1	85	71
St. George, Utah (c)	1.13	1.11	0	1	0	5	3	5	0	0	15	30
St. Louis, Mo.	1.26	1.25	0	1	6	62	22	22	0	2	45	80

(a) Zero means below detectability.
(b) Average includes 10 months from start of the regular monthly collections.
(c) Average includes 9 months from start of the regular monthly collections.

ATOMIC ENERGY COMMISSION DATA ON RADIOACTIVITY IN MILK (NOVEMBER 1959)

Routine milk monitoring is conducted at New York City, Perry, New York, and Mandan, North Dakota, with analyses performed at the Atomic Energy Commission's New York Health and Safety Laboratory. Data for these three locations for the month of November 1959 are presented below. Data for previous months were given in HASL-77, pp. 85-90,* and Radiological Health Data, April 1960.

TABLE II.—STRONTIUM-90 AND CALCIUM IN MILK (NOVEMBER 1959)

Health and Safety Laboratory (HASL) Sampling Locations

Sample location	grams Ca per		$\mu\mu$c strontium-90 per			Sr-89/Sr-90 at midpoint of sampling month
	liter	kg powder	liter	kg powder	g Ca	
Perry, N. Y. (Powdered whole milk)		9.01		63.2 ± 4.0	7.00 ± 0.43	1.0
New York City (Whole liquid milk)	1.09		11.3 ± 0.7		10.2 ± 0.6	0.6
Mandan, N. Dak. (Powdered buttermilk)		9.99		234 ± 9	23.5 ± 0.9	0.4

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*Health and Safety Laboratory Strontium Program Quarterly Summary Report, January 1, 1960, available from the Office of Technical Services, Department of Commerce, Washington 25, D. C., for $3.50.

SECTION II

AIR

PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

The Public Health Service Radiation Surveillance Network was established in 1956 in cooperation with the Atomic Energy Commission to provide a means of promptly determining increases in environmental radiation due to radioactive fallout during nuclear weapons tests. The program has proven sufficiently valuable that it has been extended to a round-the-year basis and currently consists of 44 stations at urban locations (see Fig. 1) operated by State and local health department personnel with 3 operated by U.S. Public Health Service personnel.

Measurements of gross beta radioactivity in air have been taken since they provide one of the earliest and most sensitive indications of increases of activity in the environment, and thus act as an "alert" system. These data alone are not conducive to evaluation directly of biological hazards. However, field measurements do enable the operator to estimate the amount of beta activity of particulates in the air at the station five hours after collection, by comparison to a known source, using a portable survey meter. The filters are then forwarded to the laboratory in Washington for a more refined measurement using a thin-window proportional counter.

Air samplers are in operation at the 44 stations on an average of 70% of the week. Air is drawn through a cellulose carbon loaded dust filter using a high volume air sampler. The radioactive material in fallout adhering to small dust-like particles is retained on the filter. Some gaseous fission products are adsorbed by the carbon. The contribution by gaseous fission products has represented only a small part of the total beta activity in these samples.

About 85% of the stations collect samples of precipitation which are sent to Washington for analysis. Values are now below limits of detection by present instrumentation. New equipment is being procured to measure lower values. Measurements have indicated that the bulk of deposited activity occurs through precipitation but concentrations in surface air are not directly relatable to the amount deposited through precipitation.

External gamma measurements are also made at each station (see Section IV).

More detailed data from this surveillance network are released monthly by the U. S. Public Health Service. A description of the program is printed in the Hearings on Radioactive Fallout held by the Joint Committee on Atomic Energy in May 1957, Vol. 1, page 459.

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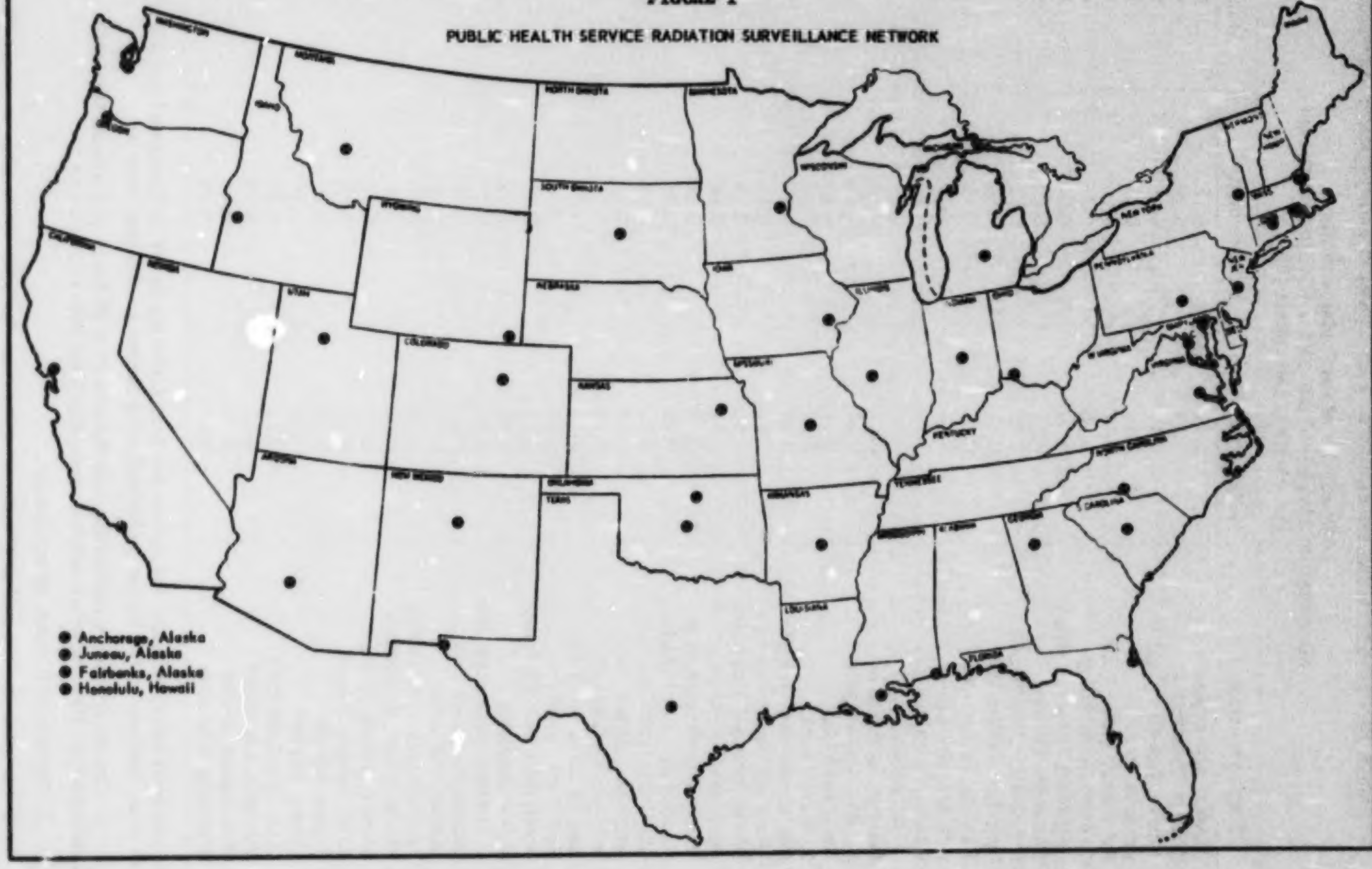
FIGURE 1

PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK


WASHINGTON
OREGON
CALIFORNIA
NEVADA
IDAHO
MONTANA
WYOMING
UTAH
COLORADO
ARIZONA
NEW MEXICO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
S. CAROLINA
NORTH CAROLINA
VIRGINIA
W. VIRGINIA
PENNSYLVANIA
NEW YORK
MAINE

- ● Anchorage, Alaska
- ● Juneau, Alaska
- ● Fairbanks, Alaska
- ● Honolulu, Hawaii

TABLE III.—PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

Radioactivity of Particulates in Air
Micromicrocuries Per Cubic Meter—Gross Beta Counts
For Month of December 1959

Station location	Weighted average	Maximum	Minimum
Alaska, Anchorage	< 0.11	0.18	< 0.10
Alaska, Fairbanks	< 0.12	0.19	< 0.10
Alaska, Juneau	< 0.10	0.11	< 0.10
Arizona, Phoenix	< 0.14	0.20	< 0.10
Arkansas, Little Rock	< 0.11	0.16	< 0.10
California, Berkeley	< 0.16	0.25	< 0.10
California, Los Angeles	< 0.20	0.54	< 0.10
Colorado, Denver	< 0.18	0.26	< 0.10
Connecticut, Hartford	< 0.11	0.15	< 0.10
District of Columbia	< 0.14	0.24	< 0.10
Florida, Jacksonville	< 0.13	0.26	< 0.10
Georgia, Atlanta	< 0.16	0.26	< 0.10
Hawaii, Honolulu	< 0.10	0.12	< 0.10
Idaho, Boise	-	-	-
Illinois, Springfield	< 0.11	0.16	< 0.10
Indiana, Indianapolis	< 0.12	0.17	< 0.10
Iowa, Iowa City	< 0.11	0.15	< 0.10
Kansas, Topeka	< 0.12	0.17	< 0.10
Louisiana, New Orleans	0.15	0.26	0.10
Maryland, Baltimore	< 0.11	0.18	< 0.10
Massachusetts, Lawrence	< 0.11	0.15	< 0.10
Michigan, Lansing	< 0.11	0.14	< 0.10
Minnesota, Minneapolis	< 0.10	0.14	< 0.10
Mississippi, Pascagoula	0.23	0.39	0.11
Missouri, Jefferson City	< 0.13	0.19	< 0.10
Montana, Helena	< 0.14	0.26	< 0.10
New Jersey, Trenton	< 0.10	< 0.10	< 0.10
New Mexico, Santa Fe	< 0.14	0.25	< 0.10
New York, Albany	< 0.11	0.16	< 0.10
North Carolina, Gastonia	< 0.15	0.25	< 0.10
Ohio, Cincinnati	0.43	1.80	0.00
Oklahoma, Oklahoma City	< 0.13	0.21	< 0.10
Oklahoma, Ponca City	< 0.10	< 0.10	< 0.10
Oregon, Portland	< 0.13	0.21	< 0.10
Pennsylvania, Harrisburg	< 0.13	0.27	< 0.10
Rhode Island, Providence	< 0.11	0.18	< 0.10
South Carolina, Columbia	< 0.13	0.19	< 0.10
South Dakota, Pierre	< 0.13	0.18	< 0.10
Texas, Austin	< 0.15	0.20	< 0.10
Texas, El Paso	< 0.21	0.44	< 0.10
Utah, Salt Lake City	< 0.12	0.23	< 0.10
Virginia, Richmond	< 0.11	0.18	< 0.10
Washington, Seattle	< 0.10	0.14	< 0.10
Wyoming, Cheyenne	< 0.14	0.26	< 0.10

It has been noted recently that values for beta activities in air in Cincinnati are somewhat higher than in other stations in the Radiation Surveillance Network. Reasons may be:

1. Cincinnati uses a membrane type filter with a 20 liters per minute flow rate, compared to a cellulose type filter at other stations sampling 1500 liters per minute.

2. Variations in counting equipment.

3. Samples are counted at Cincinnati within one day after collection, whereas the samples from other stations are counted several days later in Washington. Thus, Cincinnati values may incorporate natural beta activity from thoron daughters.

Although the relative contribution from each of these parameters has yet to be evaluated, it is recognized that some of them probably play a much more significant role than others.

TABLE IV.--RADON AND THORON AIR MEASUREMENTS

December 1-31, 1959
Cincinnati, Ohio

RADIATION SURVEILLANCE NETWORK

(Beta Activity Included)

Date	Continuous sample collection			Beta (a) activity $\mu\mu c/m^3$	Radon (b) AM $\mu\mu c/m^3$	Radon (c) PM $\mu\mu c/m^3$	Thoron (d) $\mu\mu c/m^3$
	Sample change time	Sampling period (hours)	Volume m^3				
Dec. 1	0804	23.9	28.2	0.5	166	157	1.1
2	0806	23.9	27.7	1.1	468	169	3.1
3	0810	24.0	27.4	1.0	459	189	2.5
4	0804	23.8	27.4	0.2	334	125	2.2
7	0806	71.9	82.8	0.3(3)	110	69	1.4
8	0806	23.9	23.7	0.4	170	191	1.1
9	0804	22.9	23.9	1.8	607	201	4.3
10	0804	23.9	21.9	1.6	921	186	4.5
11	0806	23.9	21.7	0	400	98	2.4
14	0808	71.9	64.7	0.3(3)	140	113	2.4
15	0804	23.8	26.7	0.6	238	154	1.6
16	0804	23.9	27.1	0.7	252	98	1.6
17	0804	23.9	27.0	0.7	307	208	1.7
18	0804	23.9	27.4	0.3	229	76	1.5
21	0804	71.9	82.0	0.2(3)	154	152	1.5
22	0804	23.9	27.1	0.6	306	72	1.8
23	0804	23.9	27.2	0	130	182	1.1
24	0804	23.8	27.1	0.2	346	-	-
28	0804	95.8	110.4	0.2(4)	98	114	1.1
29	0804	23.9	26.8	0.2	142	151	0.5
30	0804	23.9	26.2	0.2	74	51	0.5
31	0804	23.9	27.1	0.1	84	51	0.6
Average............				0.43	278	138	1.9

(a) Gross beta activity when counted one day after end of sampling or later as indicated by numeral in parenthesis.

(b) Measured within a few minutes of removal of filter from sampler and corrected back to collection time (uncorrected for thoron daughter interference).

(c) Filters are temporarily withdrawn from sampler at about 3 PM and counted. (Values are corrected back to removal time.) The filters are then replaced on sampler to complete the sampling period of about 24 hours. Thus, the values in this column are from the same filters that are counted at about 8 AM the following day.

(d) Thoron from alpha activity of filter sample counted 7 hours after taking a 24-96 hour sample.

U.S. NAVAL RESEARCH LABORATORY DATA ON RADIOACTIVITY IN AIR (DECEMBER 1959 AND JANUARY 1960)

Radioactivity measurements of air-filter samples collected at various sites along the 80th Meridian (west) are made by the U.S. Naval Research Laboratory under a program partially financed by the Atomic Energy Commission.

The daily record of fission product beta activity during December 1959 and January 1960 is shown in Table V and Table VI, respectively. The radioactivity profiles for December 1959 and January 1960 are shown in Figure 2 and Figure 3. All radioactivity concentrations are given in disintegrations per minute per cubic meter of air at the collecting site.

The low activity levels presently being encountered throughout this network necessitated that samples from several sites (Porto Alegre, San Juan, and Columbia, S.C.) be omitted from radioactivity assay because of insufficient counting capacity.

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TABLE V.—U. S. NAVAL RESEARCH LABORATORY DAILY RECORD OF FISSION PRODUCT β-ACTIVITY COLLECTED BY AIR FILTRATION

December 1959

Disintegrations/minute per cubic meter of air						
Day	Punta Arenas	Puerto Montt	Santiago	Antofagasta	Chacaltaya	Huancayo
1	-	T	0.16	0.11	T	T
2	-	0.16	0.16	0.11	T	T
3	-	0.13	0.19	0.11	T	T
4	-	0.13	0.19	0.11	T	T
5	-	T	0.16	0.14	T	T
6	-	0.11	0.11	0.14	T	T
7	-	T	0.11	0.14	T	T
8	-	T	-	0.14	T	T
9	-	T	0.35	0.14	0.11	T
10	-	T	0.15	0.14	T	T
11	-	0.16	0.15	0.14	T	T
12	-	T	0.06	0.12	T	T
13	-	T	0.06	0.12	0.11	T
14	-	T	0.06	0.12	T	T
15	-	T	0.18	0.11	0.05	T
16	-	0.14	0.18	0.11	0.05	T
17	-	T	0.15	0.12	T	T
18	-	0.11	0.15	0.12	T	T
19	-	T	0.14	0.12	T	T
20	-	0.13	0.14	0.12	T	T
21	-	T	0.14	0.12	T	T
22	-	0.11	0.14	0.12	-	T
23	-	T	0.14	0.12	-	T
24	-	T	0.14	0.18	-	T
25	-	T	0.14	0.18	-	T
26	-	T	0.13	0.12	T	T
27	-	T	0.13	0.12	T	T
28	-	T	0.13	0.12	T	T
29	-	T	0.10	0.05	T	T
30	-	0.13	0.10	0.05	T	T
31	-	T	0.17	0.04	T	T
Mean value	-	0.06	0.14	0.12	0.04	0.03

- Not received.
T Trace.

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TABLE V.—U. S. NAVAL RESEARCH LABORATORY DAILY RECORD OF FISSION PRODUCT β-ACTIVITY COLLECTED BY AIR FILTRATION—Con.

December 1959

Day	Disintegrations/minute per cubic meter of air					
	Lima	Iquitos	Guayaquil	Quito	Bogota	Miraflores
1	0.16	T	0.16	T	T	0.11
2	0.16	T	0.16	T	0.09	0.23
3	0.11	T	0.08	T	T	0.11
4	0.16	-	0.08	T	T	0.11
5	0.11	T	0.08	T	T	0.12
6	0.16	T	0.12	T	T	0.12
7	0.11	T	0.12	T	T	0.12
8	0.11	T	T	T	T	0.06
9	T	T	0.11	T	T	0.06
10	0.11	T	0.11	T	T	0.22
11	0.11	T	T	T	T	0.22
12	0.11	T	0.11	T	0.14	0.19
13	T	-	0.08	T	0.11	0.19
14	0.11	T	0.08	T	0.09	0.19
15	0.13	T	0.11	T	-	0.13
16	0.11	T	0.11	T	T	0.13
17	0.13	-	0.16	T	T	0.11
18	T	T	T	T	T	0.11
19	0.11	-	0.11	T	T	0.11
20	0.0	T	0.06	T	T	0.11
21	0.22	T	0.06	T	T	0.11
22	0.22	T	T	T	T	0.18
23	T	T	T	T	T	0.18
24	0.11	T	0.07	T	T	0.11
25	0.16	T	0.07	T	T	0.11
26	-	T	0.07	T	T	0.14
27	0.11	T	0.04	T	T	0.14
28	0.11	T	0.04	T	T	0.14
29	T	T	T	T	T	0.17
30	T	T	T	T	T	0.17
31	T	T	T	T	T	0.06
Mean value	0.10	0.03	0.08	0.03	0.04	0.14

- Not received.
T Trace.

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Table V.—U. S. NAVAL RESEARCH LABORATORY DAILY RECORD OF FISSION PRODUCT β-ACTIVITY COLLECTED BY AIR FILTRATION—Con.

December 1959

	Disintegrations minute per cubic meter of air					
Day	Miami	Washington	Bedford	Moosonee	Coral Harbour	Thule
1	0.58	0.32	0.21	0.53	0.21	0.30
2	0.55	0.32	0.14	0.18	0.24	0.32
3	0.55	0.37	T	0.16	0.27	0.16
4	0.58	0.37	T	0.21	0.27	0.21
5	0.44	0.25	0.18	0.18	0.35	0.21
6	0.55	0.25	0.28	0.23	0.35	0.23
7	0.46	0.25	0.16	0.28	0.29	0.23
8	0.30	0.18	0.11	0.28	0.29	0.25
9	0.37	0.18	0.25	0.28	0.45	0.37
10	0.69	0.31	0.35	0.30	0.37	0.41
11	0.62	0.31	0.35	0.29	0.24	0.28
12	0.53	0.25	0.15	0.24	0.32	0.32
13	0.28	0.25	0.15	0.27	0.24	0.39
14	0.51	0.25	0.15	0.25	0.35	0.28
15	0.55	0.55	0.35	0.28	0.40	0.23
16	0.55	0.55	0.51	0.32	0.45	0.32
17	0.62	0.38	0.25	0.30	0.48	0.39
18	0.74	0.38	0.25	0.28	T	0.35
19	0.46	0.15	0.15	0.23	0.29	0.30
20	0.55	0.15	0.15	0.25	0.37	0.30
21	0.51	0.15	0.15	0.21	0.29	0.21
22	0.44	0.20	0.23	0.21	0.19	0.25
23	0.44	0.20	0.21	0.09		0.23
24	0.21	0.27	0.30	0.16		0.30
25	0.09	0.27	0.30	0.35		
26	0.16	0.30	0.30	0.30		0.55
27	0.28	0.30	0.30	0.25		0.32
28	0.39	0.30	0.30	0.35		0.32
29	0.23	0.13	0.11	0.28		0.32
30	0.32	0.13	T	0.28		0.55
31	0.30	0.16	T	0.25		0.64
Mean value	0.45	0.27	0.21	0.26	0.31	0.32

- Not received.
T Trace.

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FIGURE 2

RADIOACTIVITY PROFILE FOR DECEMBER 1959

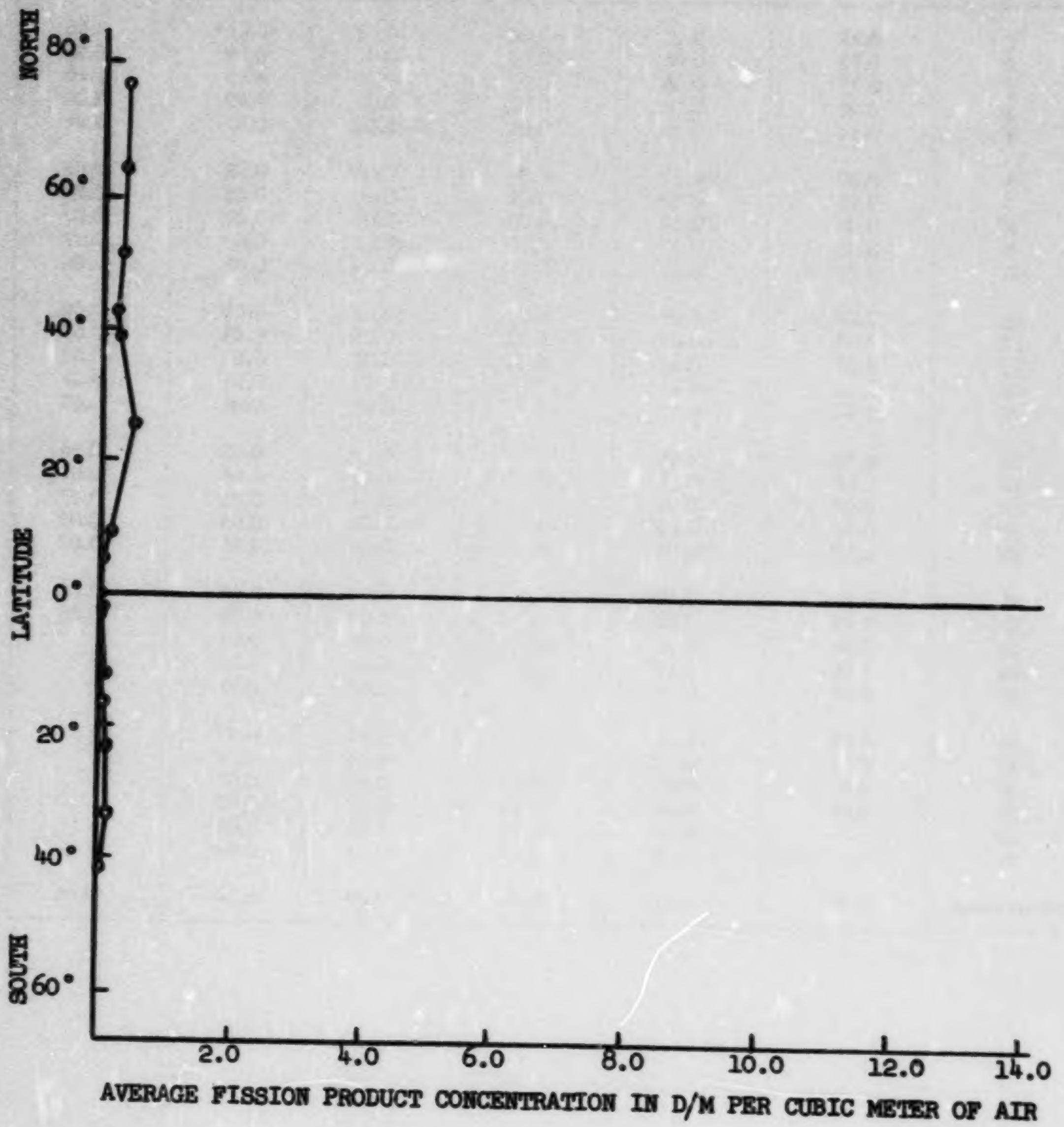

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Table VI.—U. S. NAVAL RESEARCH LABORATORY DAILY RECORD OF FISSION PRODUCT β-ACTIVITY COLLECTED BY AIR FILTRATION

January 1960

	Disintegrations/minute per cubic meter of air					
Day	Puerto Montt	Santiago	Antofagasta	Chacaltaya	Lima	Guayaquil
1	0.12	0.15	0.06	0.03	0.07	0.06
2	0.12	0.06	0.07	0.01	0.05	0.06
3	0.12	0.06	0.07	0.01	0.02	0.06
4	0.00	0.06	0.07	0.01	0.02	0.06
5	0.14	0.13	0.08	0.00	0.07	0.05
6	0.07	0.13	0.08	0.00	0.05	0.05
7	0.02	0.09	0.09	0.00	0.05	0.07
8	0.05	0.09	0.09	0.00	0.02	0.07
9	0.05	0.07	0.07	0.01	0.02	0.07
10	0.09	0.07	0.07	0.01	0.05	0.06
11	0.09	0.07	0.07	0.01	0.05	0.06
12	0.07	0.05	0.11	0.01	0.03	0.07
13	0.07	0.05	0.11	0.01	0.03	0.05
14	0.14	0.11	-	0.01	0.01	0.09
15	0.14	0.11	-	0.01	0.01	0.07
16	0.05	0.08	-	0.03	0.05	0.09
17	0.05	0.08	-	0.03	0.05	0.07
18	0.05	0.08	-	0.03	0.05	0.07
19	0.10	0.09	-	0.04	0.05	0.07
20	0.10	0.09	-	0.04	0.05	0.07
21	0.15	0.15	-	0.04	0.06	0.05
22	0.15	0.15	-	0.04	0.06	0.05
23	0.09	0.12	-	0.01	0.01	-
24	0.09	0.12	-	0.01	0.01	-
25	0.09	0.12	-	0.03	0.01	-
26	0.09	0.14	-	0.04	0.09	-
27	0.09	0.14	-	0.04	0.09	-
28	0.09	0.16	0.12	0.03	0.07	-
29	0.09	0.16	0.12	0.03	0.07	-
30	-	0.15	0.13	0.01	0.04	-
31	-	0.15	0.13	0.01	0.04	-
Mean value	0.09	0.11	0.09	0.02	0.04	0.06

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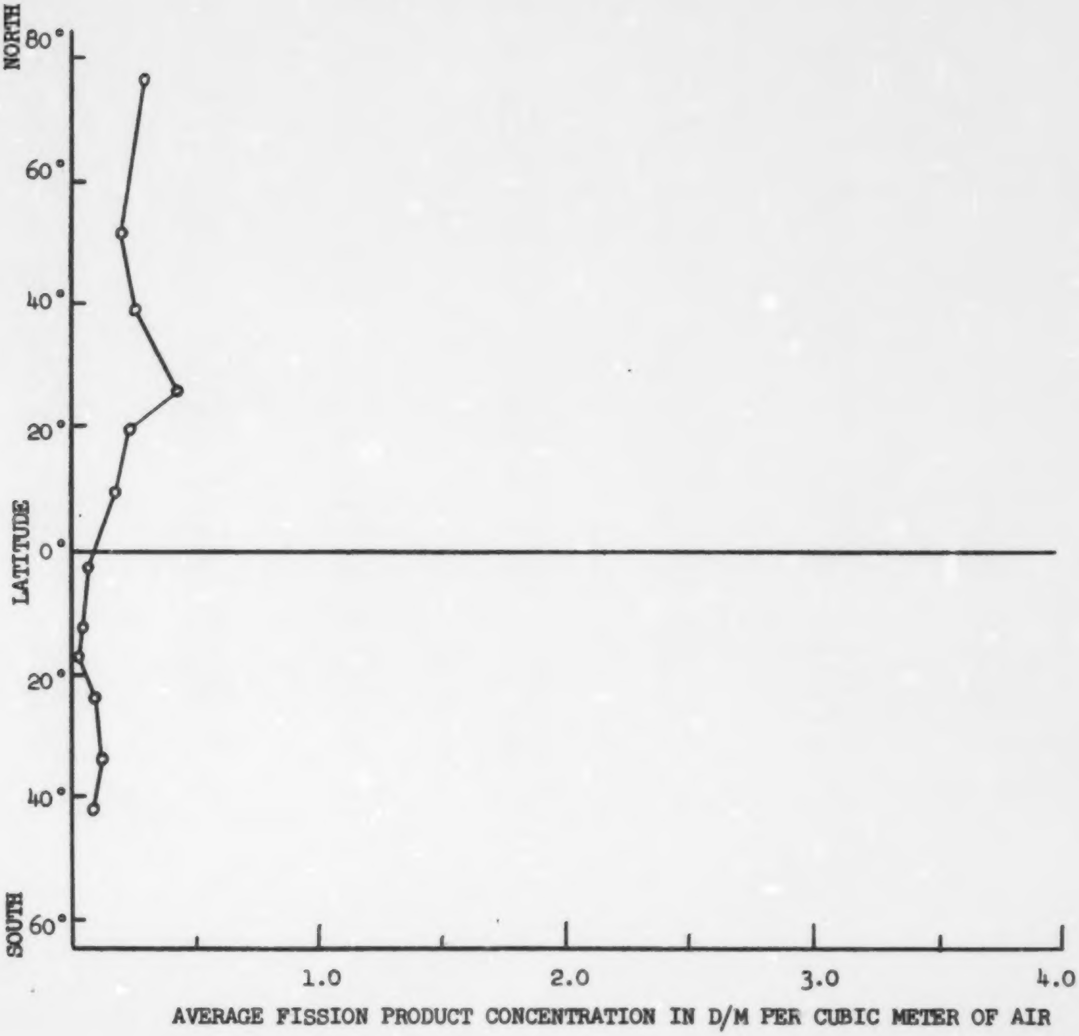
TABLE VI.—U. S. NAVAL RESEARCH LABORATORY DAILY RECORD OF FISSION PRODUCT β-ACTIVITY COLLECTED BY AIR FILTRATION—Con.

January 1960

Day	Disintegrations/minute per cubic meter of air					
	Miraflores	Mauna Loa	Miami	Washington	Moosonee	Thule
1	0.06	0.23	0.50	0.16	0.32	0.46
2	0.12	0.14	0.41	0.25	0.30	0.20
3	0.12	0.14	0.41	0.25	0.32	0.20
4	0.12	0.14	0.41	0.25	0.23	0.20
5	0.16	0.36	0.22	0.44	0.21	0.16
6	0.16	0.36	0.22	0.44	0.21	0.16
7	0.16	0.29	0.32	0.33	0.21	0.18
8	0.16	0.29	0.32	0.33	0.21	0.18
9	0.17	0.31	0.32	0.31	0.21	0.23
10	0.17	0.31	0.32	0.31	0.18	0.23
11	0.17	0.31	0.32	0.31	0.14	0.23
12	0.29	0.35	0.46	0.18	0.18	0.14
13	0.29	0.35	0.46	0.18	0.18	0.14
14	0.18	0.13	0.45	0.09	0.21	0.30
15	0.18	0.13	0.45	0.09	0.21	0.30
16	0.14	0.21	0.39	0.25	0.18	0.31
17	0.14	0.21	0.39	0.25	0.30	0.31
18	0.14	0.21	0.39	0.25	0.41	0.31
19	0.14	0.25	0.32	0.17	0.28	0.68
20	0.14	0.25	0.32	0.17	0.23	0.68
21	0.14	0.25	0.47	0.28	0.25	0.41
22	0.14	0.25	0.47	0.28	0.09	0.41
23	0.14	0.38	0.56	0.11	0.05	0.17
24	0.14	0.38	0.56	0.11	0.02	0.17
25	0.14	0.38	0.56	0.11	0.02	0.17
26	0.23	0.15	0.52	0.37	0.14	0.29
27	0.23	0.15	0.52	0.37	0.21	0.29
28	0.20	0.12	0.73	0.23	0.18	0.37
29	0.20	0.12	0.73	0.23	0.21	0.37
30	0.18	0.11	0.29	0.28	0.21	0.30
31	0.18	0.11	0.29	0.28	0.23	0.30
Mean value	0.17	0.24	0.42	0.25	0.20	0.29

FIGURE 3

RADIOACTIVITY PROFILE FOR JANUARY 1960



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'ARGONNE NATIONAL LABORATORY—ATOMIC ENERGY COMMISSION DATA ON RADIOACTIVITY IN THE AIR AT LEMONT, ILLINOIS*

Air filter measurements of ground level air at Argonne National Laboratory have been reported for September 1959 to January 1960. These measurements show a slow rate of fallout at that location during this period. All fission products including cesium-137 are down to approximately 1/100 of the concentrations observed in March-May, 1959. The concentration of cesium-137 has remained almost constant from October through December and showed a distinct increase of some 60 percent during January. The tracer, rhodium-102, which first became apparent in ground level air in September, has continued to increase through January 1960. The following table indicates the concentration of cesium-137 and rhodium-102 in ground level air from September through January. (Activity is expressed in counts/100 minutes/air filter and the volume of air passing through the filter is on the order of 5,000 cubic meters.)

Table VII

Month	Cesium-137	Rhodium-102
September	608	62
October	333	295
November	360	569
December	312	762
Januar,	500	988

The cesium-137 appearing in January does not appear to be accompanied by much rubidium-106, or cerium-144 which may indicate that the cesium is quite "old."

SUMMARY STATEMENTS ON ENVIRONMENTAL SAMPLING PROGRAMS

As a service to those concerned directly with the many radiation environmental sampling programs, summary statements showing the organization of these programs will be published as soon as completed. The following statement deals with air monitoring similar to the compilation of milk monitoring activities in Radiological Health Data, April 1960. This compilation does not purport to be complete, but does encompass most of the major efforts.

Those in charge of any regularly conducted environmental monitoring programs are encouraged to report both the organizational and administrative aspects of their programs, and the data derived therefrom, for possible inclusion in these monthly reports.

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*Reported to the Atomic Energy Commission by Dr. Philip F. Gustafson, Argonne National Laboratory.

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TABLE VIII.—A SELECTED LIST OF ENVIRONMENTAL SAMPLING

Type of sample	Operating agency	Sponsoring agency	Where sampled	Number of stations	Frequency of sampling	Year established
A. Surface Air	PHS Radiation Surveillance Network	AEC	U. S.	44	Daily	1956
B. Surface Air	Naval Research Laboratory	NRL/AEC	80th Meridian	21	Daily	1956
			Misc.	4	Weekly	1957
	Naval Research Laboratory	NRL	U. S. and overseas	7	Daily	1949
C. Surface Air	PHS, National Air Sampling Network	PHS	U. S.	233 (About 162 in operation during any given year)	24 hr. sample taken bi-weekly	1953
D. Surface Air	PHS Off-site	AEC, Nevada Test Site Organization	Nevada	11	Daily	1956
E. Surface Air	U. S. Weather Bureau	AEC	USCG Weather Stations and Commercial Ships	5-10	Four/Year	1958
F. Surface Air (Research)	Air Force Cambridge Research Center	U.S. Air Force	U.S. Air Force Stations	3	Varies with Research Needs	1957
G. Surface Air	PHS	PHS	Cincinnati	1	Daily	1958
Atomic Energy Commission						
H. Surface Air	General Electric Co.	AEC	Cincinnati, Ohio	1	Intermittent	
Surface Air	General Electric Co., Hanford Works	AEC	Hanford Works, Washington	1	Daily	
Surface Air	Sandia Corporation	AEC	Albuquerque, New Mexico	1	Daily except weekends	

NETWORKS FOR ANALYSIS OF RADIOACTIVITY IN AIR

Principal in charge	Gross radiation	Fission products	Tracers	Natural activity	Supplementary analysis
H. J. L. Rechen, Jr.	Beta	---	---	---	---
Dr. L. B. Lockhart, Jr.	Beta	Gross Beta (all stations) Radiochem. (10 stations), (bimonthly) (Sr-89, Sr-90, Y-91, Cs-137, Ce-141, Ce-144)	W-185	Pb-210	
Dr. L. B. Lockhart, Jr.	Beta	Gross Beta	---	RaB, C; ThB, C	---
E. C. Tabor	Beta	---	---	---	Suspended particulate matter, organic pollutants, including metals and non-metals
O. R. Placak	Beta and Alpha	---	---	---	---
Dr. L. Machta	---	---	---	C-14	CO_2
Dr. E. Martell	Beta	Some for Sr-90, Sr-89	Some for W-185	Some for Pb-210	---
Dr. L. R. Setter	Beta	---	---	Radon-Thoron	---
J. Z. Holland					
H. W. Barkhau et al	Beta-Gamma	---	---	---	---
B U. Anderson	Beta	---	---	---	---
H. Rarrick	Beta	---	---	---	---

TABLE VIII.—A SELECTED LIST OF ENVIRONMENTAL SAMPLING

Type of sample	Operating agency	Sponsoring agency	Where sampled	Number of stations	Frequency of sampling	Year established
H. Surface Air	Union Carbide Nuclear Co., Oak Ridge Natl. Lab.	AEC	Oak Ridge, Tennessee	1	Weekly	
Surface Air	University of California	AEC	Berkeley Livermore	1 1 (12 sites)	Daily Daily and Weekly	
Surface Air	University of California	AEC	Los Alamos, New Mexico	1	Daily	
Surface Air	University of California	AEC	Los Angeles, California	1	Daily	
Surface Air	University of Chicago	AEC	Lemont, Illionis	1	Daily	
Surface Air	University of Rochester	AEC	Rochester, New York	1	Intermittent	
I. Upper Air "HASP"	SAC, AF Dept. of Defense	Defense Atomic Support Agency (DASA)	70° N to 57° S at 100° W - 70° W	U-2 Aircraft	Two missions weekly; 40 samples per mission	1956
J. Upper Air "ASHCAN"	USAF-USWB	AEC	San Angelo, Texas	1	Monthly at several altitudes	1956

NETWORKS FOR ANALYSIS OF RADIOACTIVITY IN AIR—Con.

Principal in charge	Gross radiation	Fission products	Tracers	Natural activity	Supplementary analysis
H. H. Abee and D. M. Davis	Beta	---	---	---	---
N. B. Garden O. L. Meadors	Alpha and Beta-Gamma	---	---	---	---
Dean Meyers & Robert Elliott	Beta	---	---	---	---
Silverman, Romney, Borg, Strebe	Beta	---	---	---	---
J. S. Sedlet	Beta	---	---	---	---
H. Mermagen D. H. Maillie	Beta-Gamma	---	---	---	---
Major Albert K. Stebbins III	Beta	Sr-90, Sr-89; Some for Ba-140, Zr-95, Cs-137, Ce-144, Mo-99, Pu-239	W-185 Rh-102	---	---
J. Z. Holland	Beta	Sr-89, Sr-90, Cs-137, Ce-144, Zr-95, Ba-140	---	H-3 C-14	---

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AIR SAMPLING NETWORKS

METHODS OF PUBLICATION OF DATA

A. PHS/AEC Radiation Surveillance Network

PHS Distribution List.

Joint Committee on Atomic Energy Congressional Hearings on Radioactive Fallout, 1957.

"AEC Quarterly Statements on Fallout."

HEW Monthly Reports on Radiological Health Data.

B. U. S. Naval Research Laboratory 80th Meridian Network

NRL Monthly Letter Reports "Fission product radioactivity of the air along the 80th meridian (west)" (1956—continuing).

Radioactivity Data Sheets forwarded monthly to IGY World Data Center, Asheville, N. C. (1958-1959).

NRL Formal Reports and Publications:

L. B. Lockhart, Jr., R. A. Baus, R. L. Patterson, Jr., and A. W. Saunders, Jr., "Radiochemical Analyses of Air Filter Samples Collected During 1958," NRL Report 5390 (October 1959).

L. B. Lockhart, Jr., R. L. Patterson, Jr., and W. L. Anderson, "Measurements of the Air Concentration of Gross Fission Product Radioactivity During the IGY, July 1957-December 1958," NRL Report 5359 (September 1959).

L. B. Lockhart, Jr. and P. King, "Speculations on Atmospheric Processes via Fission Product Levels," American Scientist, Vol. 47 No. 3, 386-396 (September 1959).

L. B. Lockhart, Jr., R. A. Baus, R. L. Patterson, Jr., and A. W. Saunders, Jr., "Contamination of the Air by Radioactivity from the 1958 Nuclear Tests in the Pacific," Science, Vol. 130, No. 3368, 161-162 (July 1959).

L. B. Lockhart, Jr., R. A. Baus, P. King, and I. H. Blifford, Jr., "Atmospheric Radioactivity Studies at the U. S. Naval Research Laboratory," NRL Report 5249 (December 1958). See also Journal of Chemical Education, Vol. 36, No. 6, 291-295 (June 1959).

R. A. Baus, R. L. Patterson, Jr., A. W. Saunders, Jr., and L. B. Lockhart, Jr., "Radiochemical Analyses of Air-Filter Samples Collected During 1957," NRL Report 5239 (December 1958).

L. B. Lockhart, Jr., R. A. Baus, and I. H. Blifford, Jr., "Fission Product Radioactivity in the Air Along the 80th Meridian, January-June 1957," NRL Report 5041 (November 1957). See also Tellus, Vol. XI, No. 1, 83-90 (1959).

L. B. Lockhart, Jr., R. A. Baus and I. H. Blifford, Jr., "Atmospheric Radioactivity Along the 80th Meridian, 1956," NRL Report 4965 (July 1957).

Miscellaneous:

Joint Committee on Atomic Energy, Congressional Hearings on Radioactive Fallout, 1957, 1959.

HASL Fallout Program Quarterly Summary Reports.

U. S. Naval Research Laboratory Air Monitor Network

NRL Formal Reports and Publications:

L. B. Lockhart, Jr., "Atmospheric Radioactivity Levels at Yokosuka, Japan, 1954-1958," NRL Report 5301 (April 1959); see also J. Geophys. Research 64, 1445-1449 (1959).

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R. L. Patterson, Jr., and I. H. Blifford, Jr., "Atmospheric Carbon-14," Science 126, 26-28 (1957).

I. H. Blifford, Jr., H. Friedman, L. B. Lockhart, Jr. and R. A. Baus, "Radioactivity of the Air," NRL Report 4760 (June 1956); see also J. Atm. and Terr. Phys. 9, 1 (1956).

I. H. Blifford, Jr., L. B. Lockhart, Jr., and R. A. Baus, "Relationship Between the Air Concentration of Radioactive Fission Products and Fallout," NRL Report 4607 (November 1955); see also Nature 177, 990-2 (1956) and Science 123, 1120-21 (1955).

I. H. Blifford, Jr., and H. B. Rosenstock, "Fallout Dosages at Washington, D. C.," NRL Report 4654 (November 1955); see also Science 123, 619-622 (1956).

and others.

C. Public Health Service National Air Sampling Network

"Air Pollution Measurements of the National Air Sampling Network," 1953-57, Public Health Service Publication No. 637.

"Particulate Pollutants in the Air of the United States," by C. E. Zimmer, E. C. Tabor and A. C. Stern. Presented at Annual Meeting of Air Pollution Control Association, Los Angeles, Calif., June 1959.

"Distribution of Certain Metals in the Atmosphere of Some American Cities," by E. C. Tabor and W. V. Warren, AMA. Arch. Ind. Health 17:145-151. Feb. 1958.

"Statistical Considerations Related to the Planning and Operation of a National Air Sampling Network," by E. K. Harris and E. C. Tabor. Proc. 49th Annual Meeting, APCA, Buffalo, N. Y., May 1956, pp. 35-1 through 35-18.

"National Air Sampling Network Program Manual for the IBM 650 Computer," by A. C. Stern and C. E. Zimmer, Sanitary Engineering Center 1958.

Congressional Hearings before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, U. S. Congress "Fallout From Nuclear Weapons Tests" May 5, 1959, Vol. 1—Summary of Activity From 1953 to 1958, page 173.

National Air Sampling Network Quarterly Reports to Participating Agencies and State Health Departments.

D. PHS Off-Site Air Sampling Network for Communities Near the Nevada Test Site

Atomic Energy Commission's Thirteenth Semi-Annual Report to Congress, p. 117. Superintendent of Documents, Washington, D. C. (1952).

Atomic Energy Commission's Fourteenth Semi-Annual Report to Congress, p. 51. Superintendent of Documents, Washington, D. C. (1953).

Atomic Energy Commission's Eighteenth Semi-Annual Report to Congress, p. 81. Superintendent of Documents, Washington, D. C. (1955).

Atomic Energy Commission's Twenty-third Semi-Annual Report to Congress, p. 28. Superintendent of Documents, Washington, D. C. (1957).

Joint Committee on Atomic Energy Congressional Hearings on Radioactive Fallout 1957 and 1959.

E. United States Weather Bureau Network

Samples currently being analyzed.

F. U. S. Air Force Cambridge Research Center

Periodic Progress Reports, Special Reports and Publications, Request Distribution List.

G. PHS Radon and Thoron Air Studies

"Radiation-Environmental Health Factor," L. R. Setter. Minnesota Medicine, July 1959, Vol. 42, No. 7, pages 892-897.

HEW Monthly Reports on Radiological Health Data.

H. Atomic Energy Commission Installations

"Radioactive Fallout Data," U. S. Atomic Energy Commission, ed. by G. M. Dunning, March 1959.

I. Upper Air—High Altitude Sampling Program (HASP)

Progress Report on the High Altitude Sampling Program by Major Albert K. Stebbins, III, Radiation Division Headquarters, Defense Atomic Support Agency, Washington 25, D. C.

Statement of Dr. Frank H. Shelton before the Joint Committee on Atomic Energy Hearings, "Fallout From Nuclear Weapons Tests," May 6, 1959, Vol. 1, p. 763.

Strontium-90 Content of the Stratosphere by Herbert W. Feely, Isotopes, Inc. Science, 4 March 1960, Vol. 131, No. 3401.

J. Upper Air—"ASHCAN" Studies

"Stratospheric Radioactivity Data Obtained by Balloon Sampling," May 1959 by Joshua Z. Holland, Division of Biology and Medicine, U. S. Atomic Energy Commission. TID-555. Available from Office of Technical Services, Department of Commerce, Washington 25, D. C., $1.50.

AIR SAMPLING NETWORKS

LIST OF SAMPLING STATION LOCATIONS

A. Public Health Service Radiation Surveillance Network

Hartford, Connecticut
Trenton, New Jersey
Harrisburg, Pennsylvania
Washington, D. C.
Richmond, Virginia
Atlanta, Georgia
Columbia, South Carolina
Indianapolis, Indiana
Cincinnati, Ohio
Minneapolis, Minnesota
Pierre, South Dakota
New Orleans, Louisiana
Austin, Texas
El Paso, Texas
Ponca City, Oklahoma
Salt Lake City, Utah
Boise, Idaho
Anchorage, Alaska
Berkeley, California
Honolulu, Hawaii
Seattle, Washington
Fairbanks, Alaska
Lawrence, Massachusetts
Providence, Rhode Island
Albany, New York
Baltimore, Maryland
Gastonia, North Carolina
Jacksonville, Florida
Pascagoula, Mississippi
Springfield, Illinois
Lansing, Michigan
Iowa City, Iowa
Jefferson City, Missouri
Topeka, Kansas
Oklahoma City, Oklahoma
Santa Fe, New Mexico
Little Rock, Arkansas
Denver, Colorado
Cheyenne, Wyoming
Helena, Montana
Phoenix, Arizona
Los Angeles, California
Portland, Oregon
Juneau, Alaska

B. U. S. Naval Research Laboratory 80th Meridian Air Sampling Network (1959)

Thule, Greenland
Coral Harbour, N. W. Terr.
Moosonee, Ontario
Bedford, Massachusetts
Washington, D. C.
Columbia, South Carolina
Miami, Florida
San Juan, Puerto Rico
Miraflores, Colombia
Bogota, Colombia
Quito, Ecuador
Lima, Peru
Guayaquil, Ecuador
Iquitos, Peru
Huancayo, Peru
Chacaltaya, Bolivia
Antofagasta, Chile
Porto Alegre, Brazil
Santiago, Chile
Puerto Montt, Chile
Punta Arenas, Chile

Miscellaneous NRL/IGY Stations

Drift Station A (now C), Arctic (weekly)
Pearl Harbor, Hawaii (weekly)
Mauna Loa, Hawaii (weekly)
Subic Bay, Philippines (weekly)

U. S. Naval Research Laboratory Air Monitor Network

Washington, D. C.
Kodiak, Alaska
Wales, Alaska
Yokosuka, Japan
South Pole (formerly at Little America)
Chacaltaya, Bolivia
Lima, Peru

Similar stations operated by cooperating groups at

San Francisco, California (USNRDL)
Rio de Janeiro, Brazil

C. Public Health Service National Air Sampling Network

Station in operation every year	Station in operation during even-numbered years	Station in operation during odd-numbered years
CONNECTICUT Hartford New Haven *Nonurban	Bridgeport Stamford	New Britain Waterbury
MAINE Portland Nonurban		
MASSACHUSETTS Boston *Nonurban	Springfield Lawrence Lynn Somerville Fall River Quincy	Brockton Cambridge Lowell New Bedford Worcester
NEW HAMPSHIRE Manchester Nonurban		
RHODE ISLAND Providence Nonurban		
VERMONT Burlington Nonurban		
DELAWARE Wilmington Nonurban		
NEW JERSEY Newark *Nonurban	Trenton Camden East Orange Elizabeth	Jersey Atlantic Bayonne Paterson
NEW YORK Buffalo New York Nonurban	Albany Rochester Binghamton Yonkers	Schenectady Syracuse Utica Niagara Falls
PENNSYLVANIA Philadelphia Pittsburgh Nonurban	Harrisburg Reading Wilkes-Barre Lancaster	Allentown Johnstown Scranton Erie York Altoona
WASHINGTON, D. C.		
KENTUCKY Louisville *Nonurban		
MARYLAND Baltimore Nonurban		
NORTH CAROLINA Charlotte Nonurban	Asheville Winston-Salem	Raleigh Greensboro
PUERTO RICO San Juan Nonurban		

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*Temporarily inactivated.

Station in operation every year	Station in operation during even-numbered years	Station in operation during odd-numbered years
VIRGINIA		
Norfolk	Danville	Richmond
Nonurban	Hampton	Roanoke
WEST VIRGINIA		
Charleston	Huntington	Wheeling
*Nonurban		
ALABAMA		
Birmingham	Mobile	Montgomery
*Nonurban		
FLORIDA		
Tampa	Jacksonville	Miami
Nonurban		
GEORGIA		
Atlanta	Columbus	Augusta
*Nonurban	Macon	Savannah
MISSISSIPPI		
Jackson		
Nonurban		
SOUTH CAROLINA		
Columbia	Greenville	Charleston
Nonurban		
TENNESSEE		
Nashville	Memphis	Knoxville
Chattanooga		
*Nonurban		
ILLINOIS		
Chicago	Peoria	E. St. Louis
*Nonurban	Springfield	Rockford
INDIANA		
Indianapolis	Ft. Wayne	Terre Haute
East Chicago	Gary	Hammond
Nonurban	Evansville	South Bend
MICHIGAN		
Detroit	Kalamazoo	Flint
*Nonurban	Lansing	Grand Rapids
	Saginaw	Jackson
OHIO		
Cincinnati	Akron	Toledo
Cleveland	Lorain	Canton
Columbus	Springfield	Hamilton
Dayton		
Youngstown		
*Nonurban		
WISCONSIN		
Milwaukee	Racine	Madison
Nonurban		
IOWA		
Des Moines		Davenport
Nonurban		
KANSAS		
Wichita	Kansas City	Topeka
*Nonurban		
MINNESOTA		
Minneapolis	St. Paul	Duluth
*Nonurban		

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*Temporarily inactivated.

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Station in operation every year	Station in operation during even-numbered years	Station in operation during odd-numbered years
MISSOURI		
Kansas City		
St. Louis		
Nonurban		
NEBRASKA		
Omaha	Lincoln	
Nonurban		
NORTH DAKOTA		
Bismarck		
Nonurban		
SOUTH DAKOTA		
Sioux Falls		
Nonurban		
ARKANSAS		
Little Rock		
Nonurban		
LOUISIANA		
New Orleans	Baton Rouge	Shreveport
*Nonurban		
NEW MEXICO		
Albuquerque		
Nonurban		
OKLAHOMA		
Tulsa	Oklahoma City	
Nonurban		
TEXAS		
Dallas	Ft. Worth	Austin
Houston	El Paso	Beaumont
San Antonio	Corpus Christi	Galveston
Nonurban	Waco	Texas City
COLORADO		
Denver		
Nonurban		
IDAHO		
Boise		
Nonurban		
MONTANA		
Helena		
Nonurban		
UTAH		
Salt Lake City		
*Nonurban		
WYOMING		
Cheyenne		
Nonurban		
ALASKA		
Anchorage		
Nonurban		
ARIZONA		
Phoenix		
Tucson		
Maricopa County		
Nonurban		
CALIFORNIA		
Los Angeles	Fresno	San Bernardino
San Diego	Oakland	San Jose

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*Temporarily inactivated.

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Station in operation every year	Station in operation during even-numbered years	Station in operation during odd-numbered years
CALIFORNIA—Con.		
San Francisco	Sacramento	Long Beach
Nonurban	Pasadena	Stockton
	Burbank	Berkeley
	Richmond	Glendale
HAWAII		
Honolulu		
Nonurban		
NEVADA		
Las Vegas		
Nonurban		
OREGON		
Portland		
Nonurban		
WASHINGTON		
Seattle	Tacoma	Spokane
Nonurban		

D. Public Health Service Off-Site Air Sampling Network for Communities Near the Nevada Test Site

- Alamo, Nevada
- Beatty, Nevada
- Caliente, Nevada
- Diablo, Nevada
- Goldfield, Nevada
- Las Vegas, Nevada
- Lathrop Wells, Nevada
- Mercury, Nevada
- Warm Springs, Nevada
- Warm Springs Ranch, Nevada
- Watertown, Nevada

E. United States Weather Bureau Air Sampling Stations

These are located on United States Coast Guard Ships at Ocean Weather Stations, and selected commercial ships at other locations.

Station "Bravo"	56° 30'N, 51° 00'W
Station "Charlie"	52° 45'N, 35° 30'W
Station "Delta"	44° 00'N, 41° 00'W
Station "Echo"	35° 00'N, 48° 00'W

F. Air Force Cambridge Research Center Air Sampling Stations

Thule, Greenland	76° N (1958-1959)
Bedford, Mass.	42° N
San Juan, Puerto Rico	18° N (1958-1959)
Iquitos, Peru	3.5° S
Porto Alegre, Brazil	30° S
Puerto Montt, Chile	41° S (1958-1959)

G. Public Health Service Radon and Thoron Air Studies

Cincinnati, Ohio

H. Atomic Energy Commission Installations

- General Electric Company:
  - Aircraft Nuclear Propulsion Department, Cincinnati, Ohio
  - Hanford Works, Washington
- Sandia Corporation, Albuquerque, New Mexico
- Union Carbon and Carbide:
  - Oak Ridge National Laboratory, Tennessee
- University of California:
  - Berkeley—Livermore
  - Los Alamos Scientific Laboratory
  - Los Angeles

H. Atomic Energy Commission Installations—Con.

University of Chicago:
    Argonne National Laboratory
University of Rochester:
    Atomic Energy Project

I. Upper Air—High Altitude Sampling Program (HASP)

Flights operate between 70° N and 57° S at a longitude of 100° W to 70° W.

J. Upper Air—"ASHCAN" Studies

San Angelo, Texas

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SECTION III

WATER

PUBLIC HEALTH SERVICE NATIONAL WATER QUALITY NETWORK

The National Water Quality Network was established under the provisions of Section 4(c) of Public Law 660, which states that "...the Surgeon General shall...collect and disseminate basic data...(relating) to water pollution and the prevention and control thereof."

This Network, operated in cooperation with State and local health agencies, was started in October, 1957. At present there are 61 sampling stations located on major waterways used for public water supply, propagation of fish and wildlife, recreational purposes, and for agricultural, industrial and other uses; some of these stations are interstate, coastal, and International Boundary waters, and waters on which activities of the Federal Government may have an impact. Ultimately a total of 250 to 300 stations will be operated. A few of the more recently established stations have not yet begun to report radioactivity.

Samples of water are examined for chemical, physical, and biological quality insofar as these relate to pollution. Samples for some determinations are taken weekly, others monthly, and for some, continuous composite samples of 10 to 15 days are obtained. Radioactivity determinations are made on single samples, taken weekly.

Gross alpha and beta measurements are made on both suspended and dissolved solids in the raw surface water samples. The radioactivity levels of dissolved solids provide a rough measure of the levels which may be found in a treated water, where such water treatment removes substantially all of the suspended matter. Naturally occurring radioactive substances in the environment are the source of essentially all of the alpha activity. The contamination of the environment from man-made sources is the major contributor to the beta activity. The results are reported in micromicrocuries per liter, and are shown for each station on a given river.

While beta determinations for the first two years of the Network operation have been done on each sample weekly, the alpha determinations are reported generally on a composite sample of more than one week. Beginning with samples taken in January, 1960, beta determinations are to be performed on composite samples obtained by combining two weekly samples. The alpha data will be reported on three-month composite samples, with 1/3 of the stations being covered each month. All the data reported below represent the average of all information available for the month indicated.

Strontium-90 data are reported as being the results of determinations on composite samples for a three-month period ending in the month shown.

Additional information and data may be obtained from the following sources:

1. "National Water Quality Network Annual Compilation of Data," PHS Publication. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price $1.50.

2. "Report on National Water Quality Control Network," submitted by Dr. F. J. Weber, Chief, Division of Radiological Health, PHS, to Joint Committee on Atomic Energy Hearings on Fallout from Nuclear Weapons Tests, Vol. 1, May 1959, pages 167-169.

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FIGURE 4

PHS National Water Quality Network
SAMPLING STATIONS
1952-1959

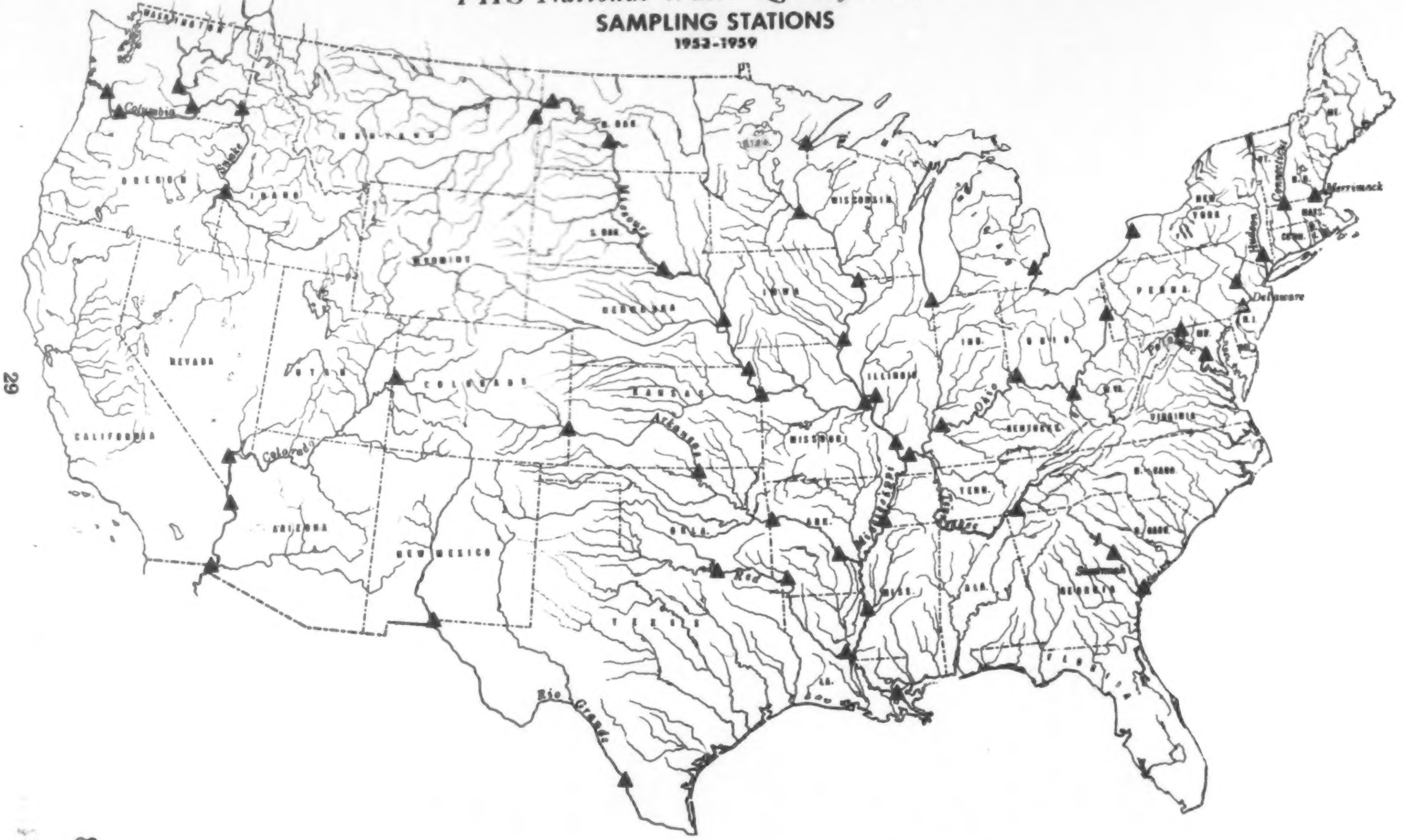
Columbia
Snake
Missouri
Arkansas
Colorado
Red
Rio Grande
Mississippi
Ohio
Tenn.
Potomac
Hudson
Delaware
Connecticut
Merrimack
Savannah
OREGON
IDAHO
MONTANA
WYOMING
NEVADA
UTAH
COLORADO
CALIFORNIA
ARIZONA
NEW MEXICO
TEXAS
N. DAK.
S. DAK.
NEBRASKA
KANSAS
OKLA.
IOWA
MISSOURI
ARK.
LA.
WISCONSIN
ILLINOIS
IND.
OHIO
KENTUCKY
TENN.
MISS.
ALA.
GEORGIA
FLORIDA
N. CAROL.
S. CAROL.
VIRGINIA
W. VA.
PENNA.
NEW YORK
MD.
N.J.
VT.
N.H.
ME.
MASS.
CONN.

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TABLE IX.—PUBLIC HEALTH SERVICE NATIONAL WATER QUALITY NETWORK RADIOACTIVITY IN RAW SURFACE WATERS

(Micromicrocuries per liter)

Station	Quarter ending Sept. 30, 1959	Month of November 1959 (Average to nearest whole number)					
		Beta activity			Alpha activity		
	Strontium-90	Susp.	Dis.	Tot.	Susp.	Dis.	Tot.
ALSEA RIVER							
Alsea, Oreg.	0.2	<1	2	3	-	-	-
ARKANSAS RIVER							
Coolidge, Kans.	1.4	0	24	24	0	32	32
Ponca City, Okla.	0.5	10	0	10	1	3	4
Fort Smith, Ark.	2.1	-	-	-	-	-	-
Pendleton Ferry, Ark.	0.3	29	4	33	34	1	35
CHATTAHOOCHIE RIVER							
Columbus, Ga.	-	0	2	2	0	0	0
COLORADO RIVER							
Loma, Colo.	0.3	67	4	71	21	10	31
Page, Ariz.	-	58	0	58	35	10	45
Hoover Dam, Ariz.-Nev.	0.9	1	6	7	0	9	9
Parker Dam, Ariz.-Calif.	0.6	4	10	14	<1	5	5
Yuma, Ariz.	0.8	10	22	32	0	6	6
COLUMBIA RIVER							
Wenatchee, Wash.	0.5	<1	4	4	0	0	0
Pasco, Wash.	1.0	75	366	441	0	0	0
Bonneville Dam, Oreg.	0.5	23	228	251	0	0	0
Clatskanie, Oreg.	0.5	23	152	175	0	0	0
CONNECTICUT RIVER							
Amherst, Mass.	-	0	0	0	-	-	-
Northfield, Mass.	1.9	0	0	0	1	0	1
DELAWARE RIVER							
Philadelphia, Pa.	0.6	<1	<1	1	1	0	1
GREAT LAKES							
Gary, Ind.	0.4	2	4	6	0	0	0
Duluth, Minn.	0.2	<1	1	2	0	0	0
Detroit, Mich.	0.6	4	3	7	1	1	2
Buffalo, N. Y.	0.8	2	6	8	0	0	0
HUDSON RIVER							
Poughkeepsie, N. Y.	1.0	14	0	14	0	0	0
MERRIMACK RIVER							
Lowell, Mass.	1.2	10	3	13	-	-	-
MISSISSIPPI RIVER							
Red Wing, Minn.	0.5	3	10	13	0	1	1
Dubuque, Iowa	1.6	5	5	10	2	1	3
Burlington, Iowa	1.1	4	3	7	2	1	3
East St. Louis, Ill.	1.2	4	5	9	2	0	2
Cape Girardeau, Mo.	1.2	13	4	17	4	2	6
West Memphis, Ark.	1.3	6	7	13	-	-	-
Delta, La.	1.3	16	9	25	2	2	4
New Orleans, La.	1.0	22	24	46	-	-	-

TABLE IX.—PUBLIC HEALTH SERVICE NATIONAL WATER QUALITY NETWORK RADIOACTIVITY IN RAW SURFACE WATERS—Con.

(Micromicrocuries per liter)

Station	Quarter ending Sept. 30, 1959	Month of November 1959 (Average to nearest whole number)					
	Strontium-90	Beta activity			Alpha activity		
		Susp.	Dis.	Tot.	Susp.	Dis.	Tot.
MISSOURI RIVER							
Williston, N. Dak.	0.5	0	0	0	-	-	-
Bismarck, N. Dak.	0.8	1	7	8	0	4	4
Yankton, S. Dak.	0.4	<1	13	14	0	18	18
Omaha, Nebr.	1.1	2	7	9	1	4	5
St. Joseph, Mo.	0.6	19	11	30	11	5	16
Kansas City, Kans.	0.3	26	10	36	8	4	12
St. Louis, Mo.	0.5	8	11	19	1	1	2
OHIO RIVER							
East Liverpool, Ohio	1.2	0	4	4	0	0	0
Huntington, W. Va.	1.0	1	4	5	0	0	0
Cincinnati, Ohio	0.9	7	2	9	-	-	-
Evansville, Ind.	2.0	-	-	-	-	-	-
Cairo, Ill.	1.2	<1	2	3	0	1	1
POTOMAC RIVER							
Williamsport, Md.	0.7	0	2	2	1	0	1
Great Falls, Md.	0.8	3	2	5	0	0	0
RED RIVER							
Denison, Tex.	1.0	<1	17	17	0	1	1
Index, Ark.	0.6	10	2	12	3	4	7
Alexandria, La.	0.4	2	3	5	12	0	12
RIO GRANDE RIVER							
El Paso, Tex.	0.3	-	-	-	-	-	-
Loredo, Tex.	0.2	2	14	16	1	2	3
Brownsville, Tex.	-	0	0	0	0	1	1
ST. MARY'S RIVER							
Sault Ste. Marie, Mich.	-	5	2	7	0	0	0
SAVANNAH RIVER							
North Augusta, S. C.	0.3	<1	2	3	<1	0	<1
Port Wentworth, Ga.	0.7	2	6	8	0	2	2
SNAKE RIVER							
Wawawai, Wash.	0.4	0	2	2	0	1	1
TENNESSEE RIVER							
Chattanooga, Tenn.	3.8	10	16	26	0	0	0
YELLOWSTONE RIVER							
Sidney, Mont.	0.7	<1	6	7	0	9	9

SECTION IV

OTHER DATA

PUBLIC HEALTH SERVICE—ATOMIC ENERGY COMMISSION

Data on Strontium-90 Activity in Human Bones

In cooperation with the Atomic Energy Commission, State Health Departments and local physicians, the Public Health Service has initiated a program of human bone collections and analyses in sections of Nevada, Utah, California, Wyoming, Colorado and Idaho. The data are summarized in Tables X and XI below. Samples were collected between March 1959 and March 1960.

The number of specimens collected to date is too small to permit firm conclusions but comparisons may be made with other similar analyses as reported in the Quarterly Statement on Fallout by the U. S. Atomic Energy Commission January 1960. (Table XII below.) Note that Table XII is based on averages for North America. It would be expected that the average for the United States alone would be at least as great as the averages for North America.

With the above factors in mind the average values for the western States (Table XI) are not significantly different from the average for North America (Table XII). However, many additional samples are needed before more definitive statements may be made.

TABLE X.—ANALYSES OF HUMAN BONE SAMPLES

Sex	Type of bone	Location	Weight (grams)			Radioactivity μμc Sr-90 per gram of—		
			Bones		CaO	Bones		Calcium
			Dry	Ash		Dry	Ash	
	Fetal Specimens:							
F	Rib, sternum, vertebrae	Northern Utah	17.4	4.2	2.34	0.11	0.44	1.1
M	Rib, sternum, vertebrae	Northern Utah	20.0	7.2	4.05	0.06	0.18	0.46
F	Rib, vertebrae, skull	Northern Utah	38.4	13.1	7.27	0.02	0.05	0.13
F	Rib, vertebrae, sternum, cranium	Northern Utah	14.5	5.2	2.80	0.07	0.20	0.54
F	Rib, sternum, vertebrae, calvarium	Northern Utah	39.7	8.9	4.73	0.07	0.31	0.82
M	Rib, vertebrae, cranium	Northern Utah	12.9	1.96		---	background	---
	Newborn (Up to age 1 year):							
F	Rib	Northern Utah	6.2	2.0	1.20	0.60	1.90	4.4
F	Rib	Northern Utah	2.4	0.7	0.40	0.46	1.60	3.8
F	Rib, vertebrae, femur	Northern Utah	20.2	6.4	3.12	0.08	0.26	0.8
F	Rib, vertebrae	Idaho	15.4	3.2			0.76	2.2 (a)
F	Rib, vertebrae	Nevada	4.6	1.4	0.77	0.29	1.35	3.5
M	Rib, vertebrae	Northern Utah	11.2	1.4	0.70	0.15	1.18	3.2
M	Rib, vertebrae	Wyoming	19.4	2.7	1.35	0.12	0.84	2.3
M	Rib, vertebrae, sternum	Northern Utah	9.8	1.7			0.49	1.40 (a)
M	Rib, vertebrae, sternum	Northern Utah	13.0	1.7			0.21	0.62 (a)
M	Rib, vertebrae, sternum	Northern Utah	11.9	3.0	1.30	0.15	0.60	1.63
M	Rib, vertebrae, sternum	Northern Utah	6.3	1.8	0.96	0.05	0.20	0.52
M	Rib, vertebrae, sternum	Northern Utah	19.8	3.3	1.76	0.14	0.83	2.19
M	Rib, vertebrae, sternum	Northern Utah	6.6	1.5	0.80	0.03	0.15	0.40
	Children (Age 1 to 5 years):							
M	Rib, vertebrae	Southern Utah	7.0	3.3	1.84	0.18	0.38	1.1
M	Rib, vertebrae	Southern Utah	5.2	2.5	1.37	0.29	0.64	1.8
M	Rib, vertebrae, sternum	Idaho	43.5	5.6	2.62	0.08	0.64	1.9
F	Rib, vertebrae, sternum	Northern Utah	3.0	1.0	0.56	0.59	1.83	4.6
F	Rib, vertebrae	Northern Utah	31.3	3.0	1.46	0.00	0.01	0.03
M	Vertebrae	Colorado	23.4	2.7	1.43	0.09	0.78	2.09
M	Vertebrae	Northern Utah	16.3	3.15	---	0.03	0.41	1.09

TABLE X. –ANALYSES OF HUMAN BONE SAMPLES–Con.

Sex	Type of bone	Location	Weight (grams)			Radioactivity μμc Sr-90 per gram of—		
			Bones		CaO	Bones		Calcium
			Dry	Ash		Dry	Ash	
	Children (Age 6 to 17 years):							
F	Rib, vertebrae	Northern Utah	16.3	6.3	3.42	0.10	0.26	0.7
M	Rib, vertebrae	Southern Utah	32.4	11.6	6.71	0.14	0.41	1.0
F	Rib, vertebrae, sternum	Northern Utah	25.3	11.7	6.57	0.18	0.39	0.71
F	Vertebrae	Northern Utah	6.1	0.8	0.43	0.07	0.53	1.45
F	Rib	Northern Utah	15.2	8.3	4.90	0.25	0.50	1.1
M	Rib	Northern Utah	9.0	5.1	2.70	0.23	0.40	1.1
M	Rib, vertebrae	Northern Utah	14.7	4.8	2.72	0.21	0.63	1.4
M	Rib, vertebrae	Northern Utah	76.4	22.4	12.10	0.10	0.33	0.8
M	Rib	Southern California	---	4.96	---	---	0.21	0.6 (a)
	Adults (Age 18 or older):							
M	Rib	Northern Utah	10.6	2.4	1.40	0.10	0.50	1.1
M	Iliac crest	California	92.3	46.8	26.30	0.09	0.20	0.6
M	Sternum	California	26.6	5.1	3.00	0.07	0.40	0.9
M	Vertebrae	Northern Utah	68.3	17.3	9.3	0.08	0.30	0.8
M	Rib	Northern Utah	16.2	9.5	5.37	0.13	0.23	0.6
M	Rib	Northern Utah	9.2	5.0	2.82	0.27	0.49	1.4
M	Foot, ankle	Northern Utah	121.7	53.8	30.10	0.00	0.06	0.2
	(Split sample—same as above)		---	20.0	---	---	0.12	0.32 (a)
M	Vertebrae	Northern Utah	45.1	14.4	8.32	0.06	0.27	0.8
M	Rib, vertebrae	Northern Utah	17.8	8.6	4.27	0.05	0.11	0.3
F	Rib, vertebrae	Northern Utah	12.9	5.6	3.17	0.11	0.27	0.7
F	Rib, vertebrae	Southern Utah	34.1	8.4	4.47	0.02	0.09	0.25

(Two additional samples were analyzed (12.0 and 7.6 micromicrocuries of strontium-90 per gram of calcium), but the amounts of the samples were so small that the validity of the results are questionable.)

(a) Analyses by the Health and Safety Laboratory of the Atomic Energy Commission. All other analyses are by the Robert A. Taft Sanitary Engineering Center, Public Health Service, Cincinnati, Ohio.

TABLE XI.—HUMAN BONE DATA—SUMMARY

(from table X)

Age classification	Number of specimens analyzed	Micromicrocuries strontium-90 per gram of calcium			
		Highest	Lowest	Average	Median
Fetal	6	1.1	~bkgd	~0.51	0.50
Newborn (Up to age 1 year)	13	4.4	0.40	2.07	2.19
Children (Ages 1-5 years)	7	4.6	0.03	1.80	1.8
Children (Ages 6-17 years)	9	1.45	0.6	0.98	1.0
Adults (Age 18 and over)	11	1.4	0.2	0.70	0.7

TABLE XII.—STRONTIUM-90 IN CHILDREN'S BONE SAMPLES COLLECTED JULY 1958-JUNE 1959

(Micromicrocuries of strontium-90 per gram of calcium)

Age group	North America (a)	Age group	North America (a)
Fetus	0.92 (59)	Fetus—Con.	
0-6 months	2.6 (14)	5-6 years	1.3 (3)
7-12 months	1.3 (1)	6-8 years	1.8 (4)
1-2 years	1.9 (3)	8-10 years	1.1 (5)
2-3 years	1.8 (3)	11-15 years	0.91 (15)
3-4 years	1.8 (7)	16-19 years	0.72 (8)
4-5 years	1.9 (5)		

(a) Data as reported to the Atomic Energy Commission by Lamont Geological Laboratory. The numbers of samples included in the averages are shown in parentheses. The data represent averages of samples collected and not necessarily levels which exist throughout the geographical areas shown.

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STRONTIUM-90 ANALYSES OF HUMAN AND ANIMAL FOOD COLLECTED IN 1958 AND 1959

Table XIII concerns samples of cabbage, potatoes, soybeans and wheat collected by the Districts of the Food and Drug Administration during 1959 and analyzed for strontium-90 by the Lamont Geological Observatory under a collaborative arrangement. An attempt was made to obtain samples from the same or contiguous counties of the states represented. Many samples represented composites from several local growers. All samples were untreated, i.e., no washing, peeling of outer layers or other preparatory procedures.

Table XIV concerns samples of animal forage collected during 1958 and 1959. Analyses for strontium-90 were made by the Lamont Geological Observatory and by the Washington laboratories of the Food and Drug Administration. In these samples there does not appear to be a relationship between the age of the sample and the percentage of total beta accounted for by strontium.

Table XV concerns samples of fresh vegetables collected during 1958 and 1959. Analyses were made of composites of several samples drawn from each state.

Table XVI concerns samples of fruits collected during 1958 and 1959. With the exception of apples and strawberries all are processed either by canning or dehydration. With one exception, it appears that the fruits generally carry a lower radioactive burden than the vegetables.

Table XVII concerns miscellaneous items discovered in the course of routine surveillance. A strong brew of tea was found to contain about 1/5 of the beta radioactivity from the tea leaves. This was made by allowing about ten times the proportion of tea leaves commonly used for the beverage to steep for three minutes in boiling water.* It should be noted that the values for bread and flour are significantly lower than those noted for wheat in Table XIII. (Editor's note: See further data on wheat, pages 40-43.)

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*Editor's note: Using the largest activity reported for tea (1365 μμc/kg) and assuming (a) two grams of tea per cup, and (b) an extraction factor of 1/5, (assuming strontium-90 is transferred similarly to gross beta) the concentration was calculated as 0.5 micromicrocuries strontium-90 per cup of tea.

TABLE XIII.—STRONTIUM-90 ANALYSES OF FOODS SAMPLED IN 1958 AND 1959 BY THE DISTRICTS OF THE FOOD AND DRUG ADMINISTRATION

Inv. No.	County of origin	Planting date	Harvest date	Micromicrocuries Strontium-90 per Kg product			
				Cabbage	Potatoes	Soybeans	Wheat
	Georgia: Atlanta District:						
72121	Fannin	May '59	July '59	46.78			
72122	Fannin	Apr. '59	Aug. '59		6.15		
57156	Peach	June '59	Nov. 11 '59				
57128	Bartow	Oct. '58	June '59				96.39
	Virginia: Baltimore District:						
59885	Accomack	Aug. '59	Oct. 29, '59	48.03			
59845	Accomack	Feb. '59	June 25, '59		5.81		
59884	Accomack	June '59	Oct. 29, '59			81.47	
59846	Accomack	Oct. '58	June '59				65.54
	New York: Buffalo District:						
65920	Wayne	Mar. '59	Aug. '59	14.86			
65917	Wayne	Apr. '59	Aug. '59		6.88		
65919	Onondaga/Oswego	May '59	Oct. '59			9.16	
65918	Wayne	Sept. '58	Aug. '59				58.87
	Ohio: Cincinnati District:						
17055	Clinton	Apr./May '59	July '59	8.15			
17054	Clinton	Apr. '59	July '59		8.25		
17773	Clinton	May 1-15, '59	Oct. 15, '59				
70903	Clinton	Oct. '58	June/July '59				30.74
	Colorado: Denver District:						
91801	Weld	May 12, '59	Oct. 8, '59	9.63			
83908	Weld	May 1, '59	Aug. 28, '59		2.21		
64981	Larimer	May 30, '58	Sept. 29, '58			8.76	
64971	Larimer	May 12, '59	Oct. 10, '59			12.80	
64930	Sedwich/Phillips	Sept. '58	July 8, '59				68.03
	Michigan: Detroit District:						
79421	Lapeer/St. Clair	July '59	Oct. 14, '59	8.7			
79738	Bay	Apr. '59	July-Sept. '59		1.115		
77662	Monroe	May '59	Nov. 1, '59				
77581	Monroe	Sept. '58	July '59				31.41
	Kansas: Kansas City District:						
55555	Johnson	Apr. '59	June 11, '59	7.25			
55556	Johnson	Mar. '59	July '59		3.74		
82810	Wilson	May '59	Sept. '59				
55909	Leavenworth	June '59	Sept. '59			44.97	
55953	Johnson	Aug. '58	June/July '59				42.38
	Minnesota: Minneapolis District:						
27259	Hennepin/Scott	Apr./May '59	July 17, '59	9.97			
27268	Sherborne	Apr. '59	July 31, '59		2.46		
27296	Scott/Sibley	May/June '59	Oct. 21, '59			23.62	
27267	Carver	Apr. '59	July '59				23.17

TABLE XIII.--STRONTIUM-90 ANALYSES OF FOODS SAMPLED IN 1958 AND 1959 BY THE DISTRICTS OF THE FOOD AND DRUG ADMINISTRATION—Con.

Inv. No.	County of origin	Planting date	Harvest date	Micromicrocuries Strontium-90 per Kg product			
				Cabbage	Potatoes	Soybeans	Wheat
	Texas: New Orleans District:						
28535	Zavala	Aug. 15, '59	Nov. 10, '59				
29189	Crosby	Feb. '59	July '59		3.57		
91926	Hale	June '59	Nov. 5, '59			18.76	
29190	Taylor/Callahan	Nov. '59	June '59				37.40
	Illinois: St. Louis District:						
54399	Madison	Apr. '59	July '59	15.45			
54398	Madison	Mar. '59	July '59		2.05		
54397	Madison	May '59	Sept. 21, '59				
54400	Montgomery	Aug. '58	July '59				42.26
	California: San Francisco District:						
40624	Monterey	May '59	July 23, '59	2.119			
48659	San Joaquin	Mar. '59	July 15, '59		0.79		
48948	Placer	Nov. '58	July '59				9.04
	Idaho and Washington: Seattle District:						
77326	Ada/Canyon	June 1, '59	Oct. 15, '59	21.19			
60417	Canyon	Apr. 10, '59	Sept. 24, '59		1.66		
76713	Walla Walla	Feb. '59	July '59				12.96

TABLE XIV.—FOOD AND DRUG ADMINISTRATION STRONTIUM-90 ANALYSES OF ANIMAL FORAGE COLLECTED DURING 1958 AND 1959

Animal fodder	Source		Date collected	Strontium-90 content $\mu\mu$c/kg	Total beta content $\mu\mu$c/kg*	Date analyzed	Sr-90/total beta (expressed as a percent)
	State	County					
Alfalfa	Nebr.	Odessa	8-12-58	138	3150	2-9-59	4.4
"	Minn.		8-13-58	806	13500	6-2-59	6.4
"	S. Dak.	S. Shore	7-16-58	797	18000	6-2-59	4.4
"	Md.		1-30-59	600	6700	6-2-59	9.0
"	Ind.	Wabash	8-5-58	1168	9500	6-2-59	12
"	Ariz.	Yuma	1-8-59	122	730	6-2-59	17
"	Mo.		5-8-59	188	19350	10-14-59	0.97
"	Ga.	Rockdale	9-23-59	1473	9897	11-6-59	15
"	N. C.	Cabarrus	9-11-59	1109	6934	11-6-59	16
"	N. C.	Buncumb	10-5-59	518	5895	11-6-59	8.8
"	Colo.		5-26-59	299	46869	10-14-59	0.63
"	Colo.		5-16-59	18	45194	10-14-59	0.03
"	N. Mex.		5-20-59	360	54811	10-14-59	0.65
Lespedeza	Ga.	Monroe	9-24-59	1321	7942	11-6-59	17
"	S. C.	Greenville	9-15-59	1698	9191	11-6-59	18
Pea vines	S. C.	Colleton	9-20-59	4628	15804	11-6-59	29
Pangolo	Fla.	Pinelles	9-16-59	537	8792	11-6-59	6.1
Timothy	Fla.	Hillsborough	9-16-59	671	10946	11-6-59	6.1

*Corrected for potassium-40.

TABLE XV.—FOOD AND DRUG ADMINISTRATION—STRONTIUM-90 ANALYSES OF SEVERAL VARIETIES OF FRESH VEGETABLES COLLECTED DURING 1958 AND 1959

Vegetable	Source	Date collected	Strontium-90 content $\mu\mu c$/kg
Spinach	Maryland	4-9-59	388
"	Virginia	3-6-59	461
"	Arkansas	2-15-59	438
"	"	4-24-59	205
"	"	4-24-59	246
"	Illinois	3-6-59	91
"	Arizona	6-12-59	21
"	California	4-12-59	83
Snap beans	Missouri	4-24-58	55
" "	New Jersey	4-24-58	56
" "	Illinois	4-24-58	40
" "	Tennessee	6-30-59	41
Cabbage	Arizona	2-15-59	6
"	California	2-15-59	31
"	Illinois	1958	18
"	Indiana	1958	27
Lettuce	California	11-3-58	5.4
"	"	11-20-58	14.3
"	"	2-9-59	60
"	New Mexico	1959	10
Celery	California	11-3-58	3.4
"	"	11-20-58	3.9
Peas	Minnesota	1958	8
Mustard greens	Tennessee	5-5-59	233
Parsley	California	3-6-59	71
"	"	6-15-59	26

TABLE XVI.—FOOD AND DRUG ADMINISTRATION—STRONTIUM-90 ANALYSES OF SEVERAL VARIETIES OF FRUITS COLLECTED DURING 1958 AND 1959

Fruit	Source	Date collected	Strontium-90 content $\mu\mu c/kg$
Apple	New York	1959	4.4
"	"	1959	5.9
"	"	1959	3.5
"	"	1959	3.1
"	"	1959	3.5
Canned peaches	California	1959	0.47
" "	"	1959	2.6
" "	"	1959	3.5
" "	"	1959	2.0
	"	1959	117
Dried apricots	California	1959	17
Raisins	California	1959	4.4
"	"	1958	11.3
Dates	Iraq	1958	7
"	"	1958	10
"	"	1958	6
"	"	1958	5
Figs	Greece	1958	13
"	Portugal	1958	11
"	"	1958	15
"	"	1958	10
Fresh strawberries	Composited California and Arkansas	5-12-59	24

TABLE XVII.--FOOD AND DRUG ADMINISTRATION--STRONTIUM-90 ANALYSES OF MISCELLANEOUS FOOD ITEMS COLLECTED DURING 1958 AND 1959

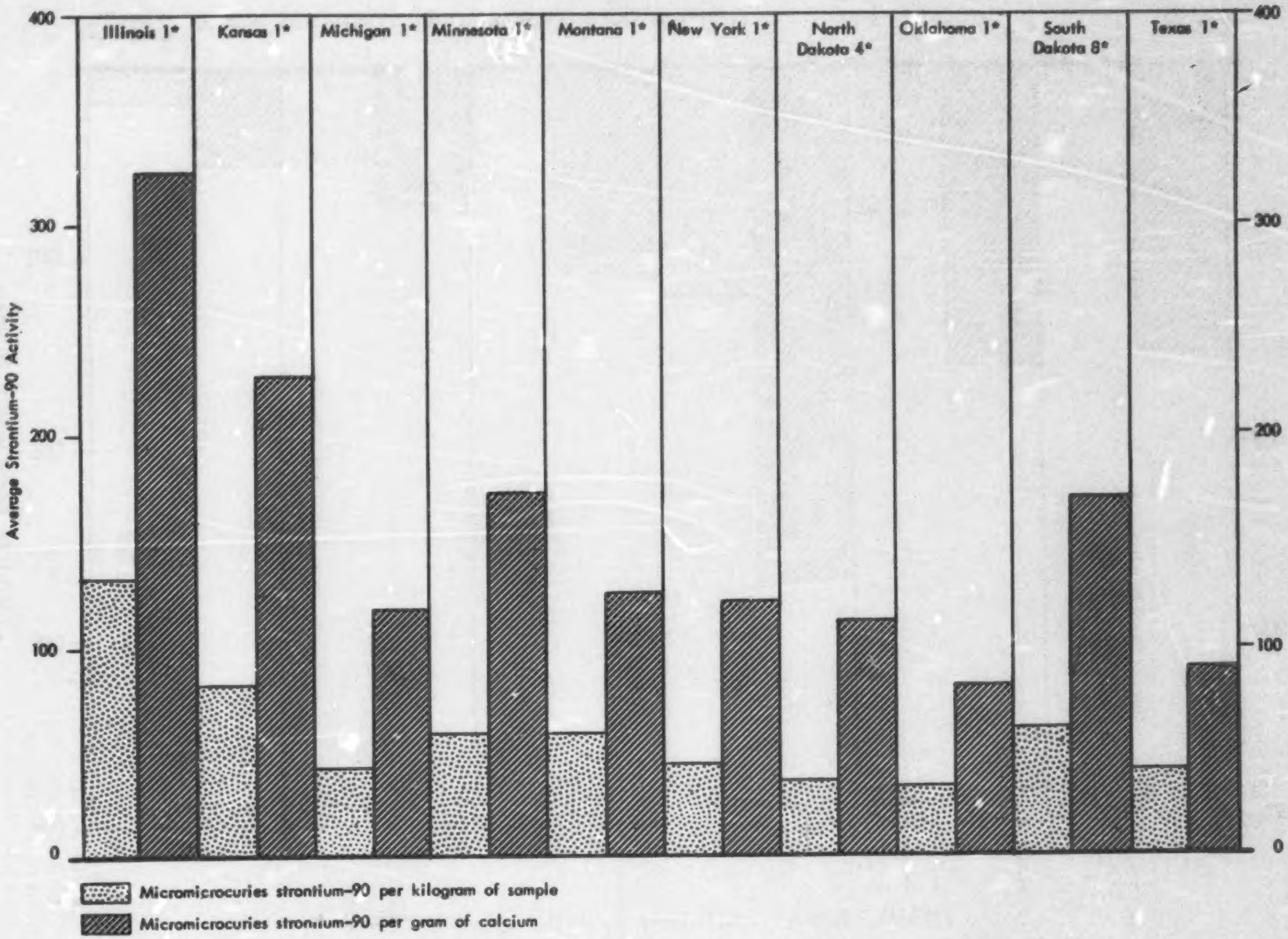
Product	Source	Date collected	Strontium-90 content $\mu\mu c/kg$
Flour	Minnesota	4-9-59	7
Fresh bread	"	4-29-59	13
Eggs	"	4-8-59	6
Egg shells	"	4-8-59	247
Cheese	Illinois	5-1-59	63
Dried skim milk	Utah	5-11-59	86
Cocoa	"	5-27-59	41
Tea	India	1958	387
"	"	10-25-59	764
"	"	10-25-59	1365
"	"	10-25-59	1132
"	"	10-25-59	1085
	Japan	8-13-58	264
Thyme	Spain	1958	1038
Tuna fish (white meat)	"	1959	8
Tuna fish (white meat)	Japan	12-10-58	0.81
Tuna fish (dark meat)	"	12-10-58	0.36
Tuna fish (vertebra)	"	12-10-58	40

ATOMIC ENERGY COMMISSION DATA ON WHEAT

The following figures 5, 6, and 7 concerning strontium-90 activity in wheat are based on data contained in the Atomic Energy Commission's Health and Safety Laboratory Report, HASL-84.

FIGURE 5

AVERAGE STRONTIUM - 90 ACTIVITY IN WHOLE WHEAT
1958



* The numeral represents the number of composite samples

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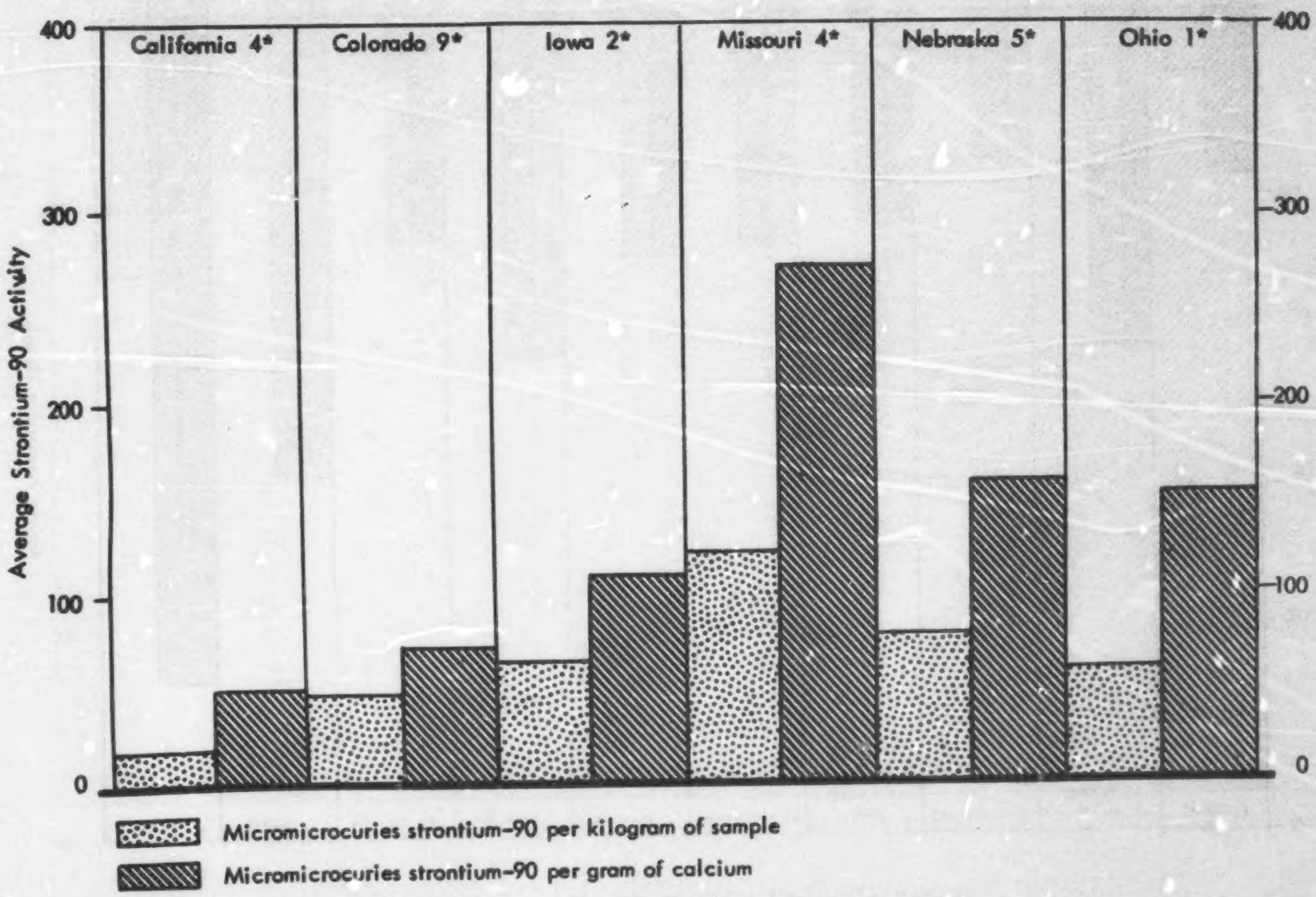
FIGURE 6

AVERAGE STRONTIUM-90 ACTIVITY IN WHOLE WHEAT
1959

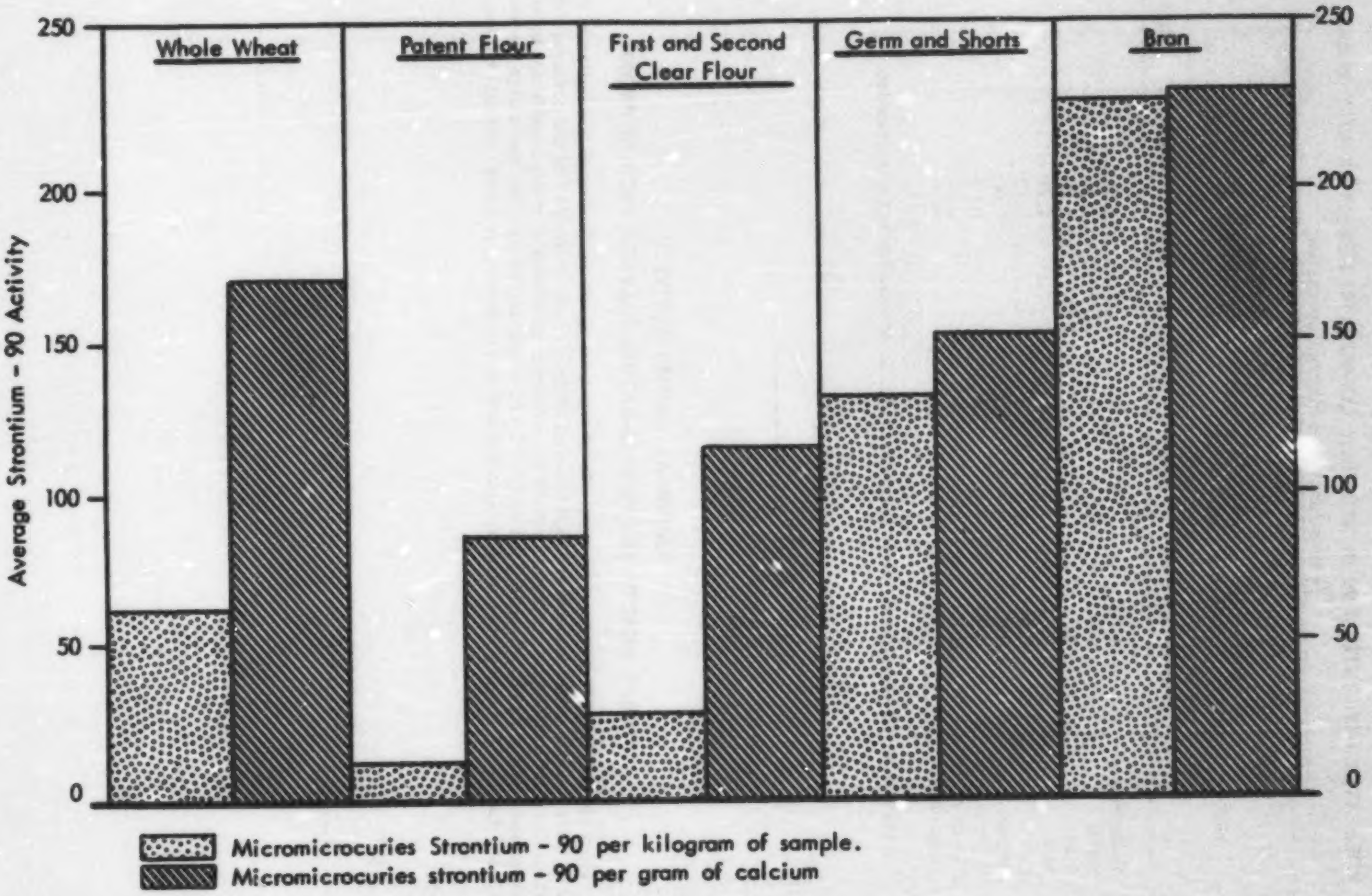


* The numeral represents the number of composite samples.

FIGURE 7

AVERAGE STRONTIUM - 90 ACTIVITY IN WHOLE WHEAT AND MILLING PRODUCTS*

1958



* Weighted according to 1958 production for nine states: Illinois, Kansas, Michigan, Minnesota, Montana, New York, North Dakota, Oklahoma and Texas.

TABLE XVIII.—STRONTIUM-90 IN MONTHLY COMPOSITED NEW YORK CITY BREAD SAMPLES*

(Strontium-90 in micromicrocuries)

1959	Per kilogram			
	Whole wheat bread		White bread	
	Grams calcium	Strontium-90	Grams calcium	Strontium-90
February	1.74	128	1.94	10
April	0.97	59	1.96	12
May	0.86	37	1.22	12
June	0.94	29	1.21	13
July	0.69	27	0.72	13
August	0.91	52	0.90	12
September	0.90	24	0.94	16
October	0.82	26	0.94	12
November	0.78	56	0.88	11

*Reported by the Health and Safety Laboratory, U. S. Atomic Energy Commission.

EXTERNAL GAMMA ACTIVITY

PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

Portable survey instruments are available at the stations of the Radiation Surveillance Network and one of their uses is to record external gamma radiation. These readings are not precise, especially for measurement of low levels but they can show the presence or absence of any significant increases above background. The differences among the values shown on the following table are within the variances anticipated due to differences in normal background and in instrument response characteristics.

TABLE XIX.—EXTERNAL GAMMA ACTIVITY PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

Milliroentgens per hour—at three feet above the ground
For month of December 1959

Station location	Average	Station location	Average
Alaska, Anchorage	0.01	Minnesota, Minneapolis	0.02
Alaska, Fairbanks	0.01	Mississippi, Pascagoula	(*)
Alaska, Juneau	0.02	Missouri, Jefferson City	0.01
Arizona, Phoenix	0.02	Montana, Helena	0.03
Arkansas, Little Rock	0.02	New Jersey, Trenton	0.02
California, Berkeley	0.01	New Mexico, Santa Fe	0.04
California, Los Angeles	0.01	New York, Albany	0.02
Colorado, Denver	0.02	North Carolina, Gastonia	0.02
Connecticut, Hartford	0.02	Ohio, Cincinnati	(*)
District of Columbia	0.02	Oklahoma, Oklahoma City	0.02
Florida, Jacksonville	0.02	Oklahoma, Ponca City	0.04
Georgia, Atlanta	0.02	Oregon, Portland	0.02
Hawaii, Honolulu	0.02	Pennsylvania, Harrisburg	(*)
Idaho, Boise	(*)	Rhode Island, Providence	0.02
Illinois, Springfield	(*)	South Carolina, Columbia	0.02
Indiana, Indianapolis	0.01	South Dakota, Pierre	0.02
Iowa, Iowa City	0.01	Texas, Austin	0.01
Kansas, Topeka	0.02	Texas, El Paso	0.02
Louisiana, New Orleans	0.01	Utah, Salt Lake City	0.02
Maryland, Baltimore	0.02	Virginia, Richmond	0.01
Massachusetts, Lawrence	0.01	Washington, Seattle	0.02
Michigan, Lansing	0.02	Wyoming, Cheyenne	0.02

* No data received.

TABLE XX.—FISSION PRODUCT RADIOACTIVITY IN SOIL AT ARGONNE NATIONAL LABORATORY, ATOMIC ENERGY COMMISSION *

(In millicuries per square mile)

Isotope	December 29, 1959	February 2, 1960
Zirconium-95—Niobium-95	200	150
Cesium-137	186	198
Rubidium-106	1,010	989
Rubidium-103	---	---
Cerium-141	---	---
Cerium-144	1,720	1,590
Totals	3,332	3,077
Dose (μ rad/hr)**	2.95	2.58

*As reported to the U. S. Atomic Energy Commission by Dr. Phillip F. Gustafson, Argonne National Laboratory.

**Editor's note: These calculated values are based on the theoretical considerations that if all of these radioisotopes found in depth within the soil were placed in an infinitely flat plane, then the indicated dose rates would result at a height of three feet above that plane.

SECTION V

ABSTRACTS

A limited number of abstracts of pertinent reports will be published in the Radiological Health Data monthly and quarterly reports. Authors are invited to submit such abstracts.

RADIONUCLIDE ANALYSIS OF CINCINNATI AIR

Krieger, H. L. and Velten, R. J.

Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

The radionuclide content of a composite specimen of Cincinnati surface air particulates collected during the period February-June 1959, was determined. The greater part of the activity was due to cerium-141/144, zirconium-95, and ruthenium-103/106. Lesser amounts of activity were contributed by other fission products and by cobalt-60 and zinc-65. The dose rate resulting from this airborne activity is small in comparison to dose from foodstuffs and other exposures.

DETERMINATION OF IODINE-131, CESIUM-137, AND BARIUM-140 IN FLUID MILK BY GAMMA SPECTROSCOPY

Hagee, G. R., Karches, G. J. and Goldin, A. S.

Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

The radionuclides Iodine-131, Cesium-137, and Barium-140 are determined in fluid milk by multichannel gamma spectroscopy, using a heavily shielded 4" x 4" sodium iodide (thallium-activated) crystal as a detector. The contribution of each of the above nuclides, and also of the naturally occurring K^{40}, to the composite gamma spectrum is evaluated by solving a set of simultaneous equations describing their mutual interferences. No sample preparation is required for the analysis.

The sensitivity of the method is about 10 $\mu\mu c$/liter, with a precision and accuracy of about 5-10 $\mu\mu c$/liter when the nuclides are present at levels up to about 50-100 $\mu\mu c$/liter. At higher levels, the precision and accuracy are about 5-10 percent.

SIMPLIFIED DETERMINATION OF STRONTIUM-90

Velten, R. J. and Goldin, A. S.

Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

A simplified approximate method for the determination of strontium-90, particularly applicable for screening purposes, is based on the preferential extraction of yttrium-90 by tributyl phosphate from strong nitric acid solution. The radioactive interferences, namely the rare earths and zirconium-niobium, and the effects of calcium and of phosphates are discussed. In many cases, where alkaline earth activities are relatively enriched, useful preliminary results may be obtained in one day. These results may be readily improved in a few additional days by correcting for impurities on the basis of decay measurements.

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RADIOLOGICAL HEALTH DATA

MONTHLY REPORT

JUNE 1960

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Division of Radiological Health

PREFACE

In August 1959, the President directed the Secretary of Health, Education, and Welfare to intensify Departmental activities in the field of radiological health. The Department was assigned, among other things, primary responsibility within the Executive Branch for the collation, analysis, and interpretation of data on environmental radiation levels. Within the Department this responsibility has been delegated to the Division of Radiological Health, Public Health Service.

As a step in the discharge of this responsibility, the Public Health Service initiated this monthly publication. The data have been submitted by agencies of the Federal government, by States, and by other sources. Each third report, starting July 1960, will contain interpretative statements as well as data.

The monthly and quarterly reports are reviewed by a Board of Editorial Advisors with representatives from the following Federal agencies:

Department of Health, Education, and Welfare
Atomic Energy Commission
Department of Defense
Department of Commerce
Department of Agriculture

Reprinted January, 1964

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SECTION I

MILK

PUBLIC HEALTH SERVICE MILK MONITORING PROGRAM

The U. S. Public Health Service Milk Monitoring Network presently consists of 12 sampling stations. This will be expanded to about 60 stations by the summer of 1960.

The initial purpose of establishing this network was in keeping with the normal and continuing program of the Department of Health, Education, and Welfare to determine trends in our changing environment, including measurement of amounts of radioactivity in water, air, milk, and other foods. Milk was the food chosen for initial testing since it is among the most important elements of the diet and is constantly available at all seasons of the year and in all climates. A primary objective of the project was to develop and simplify methods of collection and radiochemical analysis of milk to make them more suitable for larger scale programs.

The selection of the present 12 sampling stations was based on the following criteria:

1. The milk represented in each sample was from a group of farms milking a total of at least 1,000 cows.
2. The number of individual farms was small enough so that collection of collateral field data from each farm was feasible.
3. The milk samples were from a supply that was part of a metropolitan milkshed.
4. The conditions under which the milk was received were such that each sample was representative of the same farms in the production area.

The Overton, Nevada and St. George, Utah milksheds do not fulfill the 1,000 cow minimum requirement but have been included since they are part of the monitoring program around the Nevada Test Site.

One gallon samples are collected once each month and forwarded by air parcel post to the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, for radionuclide analysis. It is estimated that these samples represent 2,000 gallon lots. The concentration of iodine-131, barium-140, and cesium-137 and naturally occurring potassium-40 are all currently being measured when present in the milk by gamma scintillation spectroscopy. Total strontium and strontium-90 are determined following radiochemical separations, and the strontium-90 is calculated by measuring the build-up of the daughter decay product, yttrium-90 (after about a two week wait) using a low background anticoincidence beta counter. The total radioactive strontium is counted in a shielded internal proportional counter with the strontium-89 calculated as the difference.

Publication of the data normally requires a period of about three months after collection due to shipment, processing, decay product build-up, compilation of the data, and inclusion with other radiation data in the monthly reports.

A description of the program appears in "The Occurrence of Strontium-90, Iodine-131 and Other Radionuclides in Milk, May 1957 through April 1958," by J. E. Campbell, G. K. Murthy, A. S. Goldin, H. B. Robinson, C. P. Straub, F. J. Weber, and K. H. Lewis, American Journal of Public Health, Vol. 49, No. 2, Feb. 1959, American Public Health Association, reprinted by the Joint Committee on Atomic Energy Hearings on Fallout from Nuclear Weapons Tests, Vol. 1, May 1959.

Detailed technical descriptions of the methodology of analyses are listed below:

"Determination of I-131, Cs-137 and Ba-140 in Fluid Milk by Gamma Spectroscopy." By G. R. Hagee, G. R. Karches, and A. S. Goldin, Public Health Service.

"A Method for the Rapid Ashing of Milk for Radionuclide Analysis," Journal of Dairy Science, 42-1288, Aug. 1959. By G. K. Murthy, J. E. Campbell.

"A Method for the Determination of Radionuclides in Milk Ash." Journal of Dairy Science, 14-1276, Aug. 1959. By G. K. Murthy, L. P. Jarnagin, and A. S. Goldin.

"A Method for the Elimination of Ashing in Strontium-90 Determination of Milk," Journal of Dairy Sciences, 43 (2) 151, Feb. 1960. By G. K. Murthy, J. E. Coakley, and J. E. Campbell.

TABLE I.--PUBLIC HEALTH SERVICE DATA ON RADIOACTIVITY IN MILK

JANUARY 1960

Data from one sampling point supplying the cities listed below

Radioactivity in uuc/liter

Area	Calcium grams/liter		Iodine-131		Strontium-89		Strontium-90		Barium-140		Cesium-137	
	Jan.	Yearly average	Jan.	Yearly average	Jan.	Yearly average	Jan.	Yearly average	Jan.	Yearly average	Jan.	Yearly average
Atlanta, Ga.	1.24	1.18	(a) 0	3	(a) 0	40	12.8	15.4	(a) 0	(a) 0	45	83
Austin, Tex.	1.15	1.12	0	2	0	21	7.3	6.2	0	< 1	25	45
Chicago, Ill.	1.16	1.10	0	2	0	11	9.2	8.8	0	0	35	54
Cincinnati, Ohio	1.11	1.13	0	1	0	16	11.5	12.8	0	0	45	48
Fargo, N. Dak. Moorhead, Minn.	1.22	1.13	0	1	0	14	11.3	14.3	0	0	45	59
New York, N. Y.	1.07	1.08	0	2	0	8	10.2	9.6	0	0	45	51
Overton, Nev.(b)	1.17	1.08	0	< 1	0	2	3.9	3.2	0	0	15	23
Sacramento, Calif.	1.16	1.14	0	< 1	0	12	2.7	4.9	0	0	10	42
Salt Lake City, Utah	1.13	1.12	0	2	0	8	7.5	6.9	0	0	40	44
Spokane, Wash.	1.25	1.17	0	3	0	20	13.9	12.6	0	0	50	69
St. George, Utah(c)	1.10	1.11	0	< 1	0	4	3.8	4.5	0	0	15	29
St. Louis, Mo.	1.35	1.26	0	< 1	7	56	21.8	22.5	0	< 1	40	78

(a) Zero means below detectability.
(b) Average includes 11 months from start of the regular monthly collections.
(c) Average includes 10 months from start of the regular monthly collections.

ATOMIC ENERGY COMMISSION DATA ON RADIOACTIVITY IN MILK

Routine milk monitoring is conducted at New York City, Perry, New York, and Mandan, North Dakota, with analyses performed at the Atomic Energy Commission's New York Health and Safety Laboratory. Data for these three locations for the month of December 1959 are presented below. Data for previous months were given in HASL-Reports; the most recent being listed below* and Radiological Health Data, April and May 1960.** A list of publications for previous data may be found in Radiological Health Data, April 1960.

TABLE II.--STRONTIUM-90 AND CALCIUM IN DECEMBER 1959 MILK

Health and Safety Laboratory (HASL) Sampling Locations

	$\mu\mu$c strontium-90 per			grams Ca per	
	liter	kg (powder)	g Ca	liter	kg (powder)
Perry, N. Y. (Powdered whole milk)		59.9	7.7		7.8
New York City (Whole liquid milk)	11.7		9.2	1.3	
Mandan, N. Dak. (Powdered buttermilk)		282	25.0		11.3

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*Health and Safety Laboratory Fallout Program Quarterly Summary Report, April 1960, available from the Office of Technical Services, Department of Commerce, Washington 25, D. C., for $3.50.

**U. S. Department of Health, Education & Welfare Publications available from the Office of Technical Services, Department of Commerce, Washington 25, D. C. Price 50 cents single issue.

SECTION II

AIR

PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

The Public Health Service Radiation Surveillance Network was established in 1956 in cooperation with the Atomic Energy Commission to provide a means of promptly determining increases in environmental radiation due to radioactive fallout during nuclear weapons tests. The program has proven sufficiently valuable that it has been extended to a round-the-year basis and currently consists of 44 stations at urban locations (see figure 1) operated by State and local health department personnel except 3 which are operated by U. S. Public Health Service personnel.

Measurements of gross beta radioactivity in air have been taken since they provide one of the earliest and most sensitive indications of increases of activity in the environment, and thus act as an "alert" system. These data alone are not conducive to evaluation directly of biological hazards. However, field measurements do enable the operator to estimate the amount of beta activity of particulates in the air at the station five hours after collection, by comparison to a known source, using a portable survey meter. The filters are then forwarded to the laboratory in Washington for a more refined measurement using a thin window proportional counter.

Air samplers are in operation at the 44 stations on an average of 70% of the week. Air is drawn through a cellulose carbon loaded dust filter at a rate of 55 CFM using a high volume air sampler. The radioactive material in fallout adhering to small dust-like particles is retained on the filter. Some gaseous fission products are absorbed by the carbon. The contribution by gaseous fission products has represented only a small part of the total beta activity in these samples.

About 88% of the stations collect samples of precipitation which are sent to Washington for analysis. Values are now below limits of detection by present instrumentation. New equipment is being procured to measure lower values. Measurements have indicated that the bulk of deposited activity occurs through precipitation but concentrations in surface air are not directly relatable to the amount deposited through precipitation.

FIGURE 1

PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

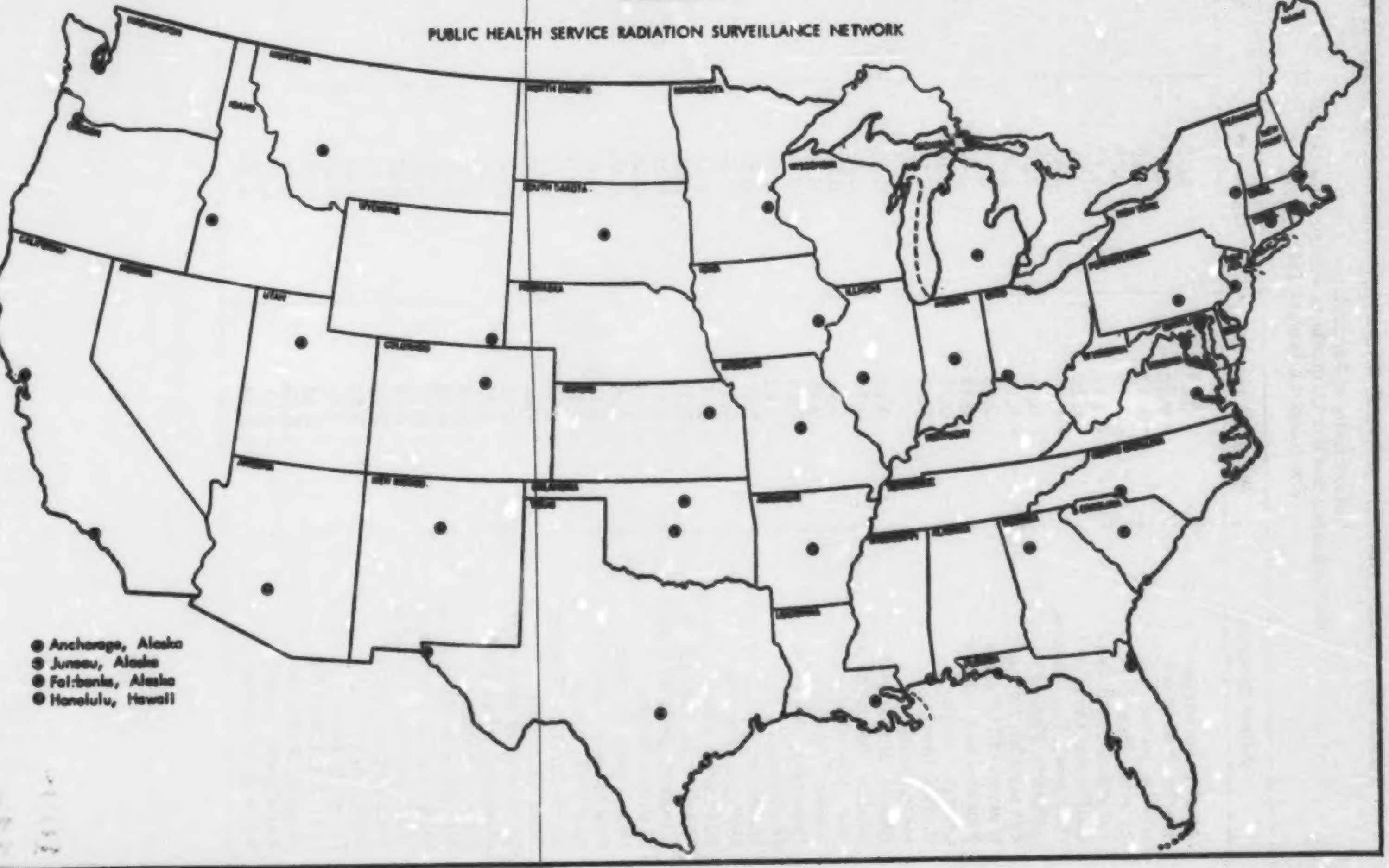
● Anchorage, Alaska
● Juneau, Alaska
● Fairbanks, Alaska
● Honolulu, Hawaii

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TABLE III.—PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

Radioactivity of Particulates in Air
Micromicrocuries Per Cubic Meter—Gross Beta Counts
For month of January 1960

Station location	Weighted average	Maximum	Minimum
Alaska, Anchorage	< 0.10	0.18	< 0.10
Alaska, Fairbanks	< 0.10	0.17	< 0.10
Alaska, Juneau	< 0.11	0.16	< 0.10
Arizona, Phoenix	< 0.14	0.19	< 0.10
Arkansas, Little Rock	< 0.11	0.14	< 0.10
California, Berkeley	< 0.12	0.24	< 0.10
California, Los Angeles	< 0.14	0.24	< 0.10
Colorado, Denver	< 0.16	0.26	< 0.10
Connecticut, Hartford	< 0.11	0.16	< 0.10
District of Columbia	< 0.13	0.25	< 0.10
Florida, Jacksonville	< 0.12	0.22	< 0.10
Georgia, Atlanta	< 0.11	0.16	< 0.10
Hawaii, Honolulu	< 0.12	0.22	< 0.10
Idaho, Boise	-	-	-
Illinois, Springfield	< 0.15	0.35	< 0.10
Indiana, Indianapolis	< 0.11	0.19	< 0.10
Iowa, Iowa City	< 0.11	0.21	< 0.10
Kansas, Topeka	< 0.11	0.16	< 0.10
Louisiana, New Orleans	0.13	0.16	0.11
Maryland, Baltimore	< 0.12	0.20	< 0.10
Massachusetts, Lawrence	< 0.11	0.14	< 0.10
Michigan, Lansing	< 0.11	0.19	< 0.10
Minnesota, Minneapolis	< 0.10	0.13	< 0.10
Mississippi, Pascagoula	< 0.21	0.35	< 0.10
Missouri, Jefferson City	< 0.15	0.21	< 0.10
Montana, Helena	< 0.11	0.15	< 0.10
New Jersey, Trenton	< 0.10	0.18	< 0.10
New Mexico, Santa Fe	< 0.17	0.25	< 0.10
New York, Albany	< 0.12	0.29	< 0.10
North Carolina, Gastonia	< 0.14	0.17	< 0.10
Ohio, Cincinnati	0.42	1.30	0.10
Oklahoma, Oklahoma City	< 0.13	0.31	< 0.10
Oklahoma, Ponca City	< 0.10	0.10	< 0.10
Oregon, Portland	< 0.14	0.27	< 0.10
Pennsylvania, Harrisburg	< 0.12	0.29	< 0.10
Rhode Island, Providence	< 0.11	0.16	< 0.10
South Carolina, Columbia	< 0.13	0.18	< 0.10
South Dakota, Pierre	< 0.12	0.15	< 0.10
Texas, Austin	< 0.12	0.23	< 0.10
Texas, El Paso	0.27	0.41	0.13
Utah, Salt Lake City	< 0.12	0.20	< 0.10
Virginia, Richmond	< 0.12	0.37	< 0.10
Washington, Seattle	< 0.11	0.17	< 0.10
Wyoming, Cheyenne	< 0.12	0.18	< 0.10

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TABLE IV.—RADON AND THORON AIR MEASUREMENTS

January 4-29, 1960
Cincinnati, Ohio

RADIATION SURVEILLANCE NETWORK

(Beta activity included)

Date	Continuous sample collection			Beta (a) activity $\mu\mu c/M^3$	Radon (b) AM $\mu\mu c/M^3$	Radon (c) PM $\mu\mu c/M^3$	Thoron (d) $\mu\mu c/M^3$
	Sample change time	Sampling period (hours)	Volume M^3				
Jan. 4	0806	95.9	107.0	0.2	116	111	0.9
5	0804	23.8	27.0	0.5	177	144	1.1
6	0816	24.0	30.6	0.4	214	133	1.3
7	0812	23.9	30.5	0.7	276	85	2.0
8	0804	23.9	30.4	0.1 (3)	141	136	0.6
11	0802	71.8	90.9	0.4	278	193	2.3
12	0808	24.1	30.4	0.7	289	104	1.9
13	0802	23.9	30.3	0.4	56	81	0.6
14	0810	24.1	30.4	0.3	164	159	0.7
15	0806	23.9	29.7	0.2 (3)	73	179	0.7
18	0808	72.0	88.6	0.4	203	88	1.2
19	0812	24.1	29.9	0.2	50	66	0.4
20	0806	23.9	29.8	0.4	67	55	0.4
21	0806	24.0	30.4	0.4	108	127	0.6
22	0802	23.9	30.1	1.3 (3)	92	139	0.4
25	0804	72.0	89.0	0.2	145	127	1.4
26	0804	24.0	29.8	0.5	266	147	1.3
27	0806	23.9	29.3	1.3	299	121	1.8
28	0806	23.9	27.7	0.6	177	144	1.3
29	0804	23.9	26.1	0.3 (3)	286	132	1.1
29	1500	6.8	(Hrs.) 7.2^{++}	-	-	70	-
	Average......................................			0.4	174	130	1.1

(a) Gross beta activity when counted one day after end of sampling or later as indicated by numeral in parenthesis.

(b) Measured within a few minutes of removal of filter from sampler and corrected back to collection time (uncorrected for thoron daughter interference).

(c) Filters are temporarily withdrawn from sampler at about 3 p.m. and counted. (Values are corrected back to removal time.) The filters are then replaced on sampler to complete the sampling period of about 24 hours. Thus, the values in this column are from the same filters that are counted at about 8 a.m. the following day.

(d) Thoron from alpha activity of filter sample counted 7 hours after taking a 24-96 hour sample.

SURFACE AIR MEASUREMENTS

Transient increases in concentrations of beta radioactivity were observed at some of the 44 stations located in the United States of the Public Health Service-Atomic Energy Commission Radiation Surveillance Network during February 1960. A summary report of the data from all of these stations for the month of February will be given in the next issue of Radiological Health Data. The data from 17 stations were selected and reproduced on pages 10-16 to indicate the general trend of radioactivity in the air during the latter part of February. Data from this network indicated an arrival in the United States between February 22-24, 1960. Some measurements were made of the decay of the beta activity yielding results that were only roughly comparable to an origin date of February 13, 1960 (the date of the nuclear detonation in the Sahara).

Measurements by the U. S. Naval Research Laboratory were also made which occurred along the 80th Meridian indicated on arrival date at 10° North, February 25-26. The profile of radioactivity for average measurements of surface air at 14 stations along the 80th Meridian for February 1960 is shown in Figure 2, with a maximum value occurring at 10° North of 3.7 disintegrations per minute (1.8 micromicrocuries) of beta activity per cubic meter of air (at time of measurement which was about two weeks after collection date).

During February of 1959, the average gross beta activity for the United States (PHS Surveillance Network) was about 5.5 micromicrocuries per cubic meter and for the station of 10° North (NRL data) was 6.7 micromicrocuries per cubic meter.

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FIGURE 2

RADIOACTIVITY PROFILE FOR FEBRUARY 1960

U. S. NAVAL RESEARCH LABORATORY

Average Measurements of Surface Air at 14 Stations Along 80th Meridian
February 1960

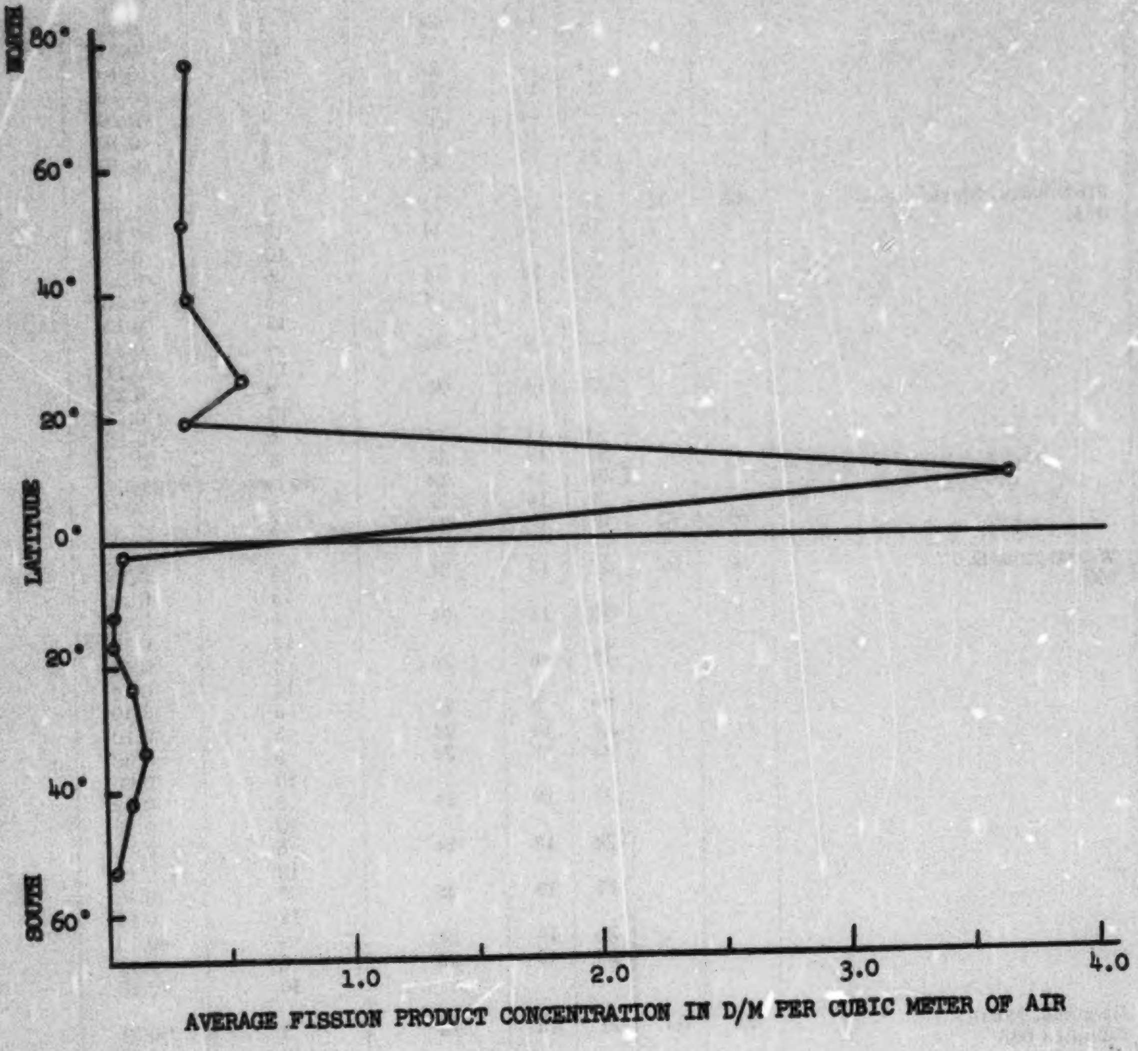

TABLE V.—GROSS BETA RADIOACTIVITY OF PARTICULATES IN AIR

PHS Radiation Surveillance Network

Station location	End of collection (Greenwich mean time)				Sampling period, hours	Days after collection	$\frac{\mu\mu c}{M^3}$*
	Yr.	Mo.	Day	Hr.			
Hartford, Connecticut 011	60	02	18	14	24	5	0.15
						14	<0.10
			19	14	24	4	<0.10
			20	18	28	5	<0.10
			21	21	27	4	<0.10
			22	14	17	3	<0.10
			23	14	24	3	0.43
						10	0.31
			24	14	24	6	<0.10
			25	14	24	5	<0.10
			26	14	24	4	<0.10
			27	16	26	4	<0.10
			28	19	27	3	<0.10
Providence, Rhode Island 013	60	02	15	14	72	3	<0.10
			16	14	24	3	0.16
						10	0.19
			17	14	24	6	<0.10
			18	14	24	5	0.15
						12	0.15
			19	14	24	4	0.11
						11	0.11
			23	14	96	3	0.25
						10	0.16
			24	14	24	6	<0.10
			25	14	24	4	<0.10
			26	14	24	No sample received	
			29	14	72	4	<0.10
	60	03	01	14	24	3	<0.10
Washington, D. C. 032	60	02	17	18	24	6	0.15
						13	0.12
			18	18	24	5	0.16
						12	0.19
			19	18	24	5	0.14
						12	0.14
			20	18	24	3	<0.10
			21	18	24	3	<0.10
			22	18	24	3	0.33
						10	0.20
			23	18	24	3	0.23
						10	0.19
			24	18	24	6	0.16
						13	0.16
			25	19	25	5	0.20
						12	0.16
			26	19	24	4	<0.10
			27	18	23	3	0.11
						10	<0.10
Gastonia, North Carolina 033	60	03	21	13	72	3	0.21
						10	0.22
			22	13	24		
			23	13	24	7	0.26
						14	0.28
			24	13	24	6	0.27
						13	0.22

*At time of measurement.

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TABLE V.—GROSS BETA RADIOACTIVITY OF PARTICULATES IN AIR—Con.

PHS Radiation Surveillance Network

Station location	End of collection (Greenwich mean time)				Sampling period, hours	Days after collection	$\frac{\mu\mu c}{M^{3*}}$
	Yr.	Mo.	Day	Hr.			
Gastonia, North Carolina 033—Con.			25	13	24	5	0.37
						12	0.32
			28	13	72	4	0.40
						11	0.27
			29	13	24	7	0.23
						14	0.29
			30	13	24	6	0.13
						13	0.16
			31	13	24	4	0.13
						11	0.16
Jacksonville, Florida 041	60	02	16	14	24	3	0.14
						10	0.15
			17	14	24	6	0.22
						13	0.19
			18	14	24	5	0.21
						12	0.19
			19	14	24	4	<0.10
			22	14	72	3	0.21
						10	0.15
			23	14	24	3	0.25
						10	0.15
			24	14	24	6	0.30
						13	0.26
			25	14			
			26	14	18		
			29	14	72	4	0.26
						11	0.21
		03	01	13	23	3	0.31
						10	0.26
			02	14	24	5	0.27
							0.25
			03	14	24	4	0.34
						11	0.29
			04	14	24	3	0.13
						10	0.11
Springfield, Illinois 051	60	02	17	16	24	9	0.15
						16	0.12
			18	15	24	8	<0.10
			19	15	24	7	0.12
						14	0.10
			20	15	24	6	0.11
						13	0.15
			21			No sample received	
			22	15	24	4	0.56
						11	0.38
			23	15	24	3	0.15
						10	0.12
			24	15	24	3	0.12
						10	0.13
			25	15	24	11	0.12
						18	<0.10
			26	15	24	10	<0.10
			27			No sample received	
Austin, Texas 073	60	02	16	14	24	7	<0.10
			17	14	24	6	<0.10

*At time of measurement.

TABLE V.—GROSS BETA RADIOACTIVITY OF PARTICULATES IN AIR—Con.

PHS Radiation Surveillance Network

Station location	End of collection (Greenwich mean time)				Sampling period, hours	Days after collection	$\frac{\mu\mu c}{M^3}$*
	Yr.	Mo.	Day	Hr.			
Austin, Texas 073—Con.			17	21	7		
			19	14	24	7	<0.10
			22	14	72	4	<0.10
			23	14	24	7	0.59
						14	0.39
			24	15	25	6	0.17
						13	0.13
			25	14	23	5	0.13
						12	0.13
			26	15	25	7	<0.10
			29	15	72		
		03	01	16	25	6	<0.10
Santa Fe, New Mexico 074	60	02	15	16	72	3	0.16
						10	0.11
			16	16	24	3	0.10
						10	<0.10
			17	16	24	6	0.15
						13	0.15
			18	16	24	6	<0.10
			19	16	24	4	0.15
						11	0.16
			23	16	96	3	0.29
						10	0.18
			26	16	72	4	0.28
						11	0.27
			29	16	72	4	0.66
						11	0.50
	60	03	01	16	24	6	0.22
						13	0.18
			02	16	24	5	0.16
						12	0.15
			03	16	24	4	0.33
						11	0.32
			04	16	24	3	<0.10
			07	16	72	4	0.48
						11	0.39
			08	16	24	6	0.67
						13	0.51
			09	16	24	5	0.41
						12	0.34
			10	16	24	4	0.76
						11	0.67
			11	16	24	3	0.58
						10	0.43
			14	16	72	4	0.47
						11	0.42
			15	16	24	3	0.32
						10	0.25
			16	16	24	6	0.26
						13	0.22
			17	16	24	5	0.18
						12	0.17
			18	16	24	5	0.21
						12	0.20

*At time of measurement.

TABLE V.—GROSS BETA RADIOACTIVITY OF PARTICULATES IN AIR—Con.

PHS Radiation Surveillance Network

Station location	End of collection (Greenwich mean time) Yr.	Mo.	Day	Hr.	Sampling period, hours	Days after collection	$\frac{\mu\mu c}{M^{3*}}$
El Paso, Texas 075	60	02	16	19	24	3	0.24
						10	0.17
			17	18	23	6	0.15
						13	0.16
			18	19	25	5	0.13
						12	0.14
			19	19	24	4	0.19
						11	0.16
			22	19	72	3	0.30
						10	0.27
			23	19	24	3	0.77
						10	0.49
			24	19	24	5	0.20
						12	0.19
			25	19	24	5	0.17
						12	0.25
			26	19	24	No sample received	
			29	19	72	4	1.26
						11	1.03
	60	03	01	19	24	6	0.40
						13	0.36
			02	19	24	5	0.16
						12	0.13
			03	19	24	4	0.70
						11	0.67
			04	19	24	3	0.51
						10	0.45
			07	19	72	3	1.23
						10	1.00
			08	19	24	6	0.97
						13	0.79
			09	19	24	5	1.23
						12	0.99
			10	20	25	4	1.24
						11	0.99
			11	19	23	3	1.08
						10	0.80
			14	19	72	4	0.74
						11	0.63
			15	19	24	3	0.55
						10	0.47
			16	19	24	6	0.45
						13	0.41
			17	19	24	5	0.43
						12	0.36
			18	19	24	4	0.34
						11	0.31
Denver, Colorado 081	60	02	15	23	79	4	0.12
						11	0.12
			16	17	18	8	0.18
						15	0.17
			17	16	23	6	0.13
						13	<0.10
			18	20	28	6	<0.10
			19	16	20	7	0.16
						14	0.20

*At time of measurement.

TABLE V.—GROSS BETA RADIOACTIVITY OF PARTICULATES IN AIR—Con.

PHS Radiation Surveillance Network

Station location	End of collection (Greenwich mean time)				Sampling period, hours	Days after collection	$\frac{\mu\mu c}{M^{3*}}$
	Yr.	Mo.	Day	Hr.			
Denver, Colorado 081—Con.			22	16	72	4	0.92
						11	0.55
			23	16	24		
			25	18	50	5	0.21
						12	0.18
			26	16	22	7	0.15
						12	0.21
			29	18	74	7	0.21
						14	0.22
	60	03	02	16	46	5	0.25
						12	0.27
Salt Lake City, Utah 082	60	02	14	14	23	4	0.10
						11	<0.10
			15	17	27	3	0.10
						10	<0.10
			16	16	23	3	0.14
						10	0.11
			17	16	24	6	<0.10
			18	16	24	6	<0.10
			19	18	26	4	0.97
						11	0.49
			20	16	22	5	0.66
						12	0.44
			21	14	22	5	0.31
						12	0.25
			22	17	27	4	0.24
						11	0.18
			23	19	26	7	0.11
						14	0.10
			24	16	21	6	0.15
						13	0.20
			25	16	24	5	0.24
						12	0.22
Phoenix, Arizona 092	60	02	23	16	96	7	0.22
						14	0.20
			25	16	48	5	0.20
						12	0.11
			29	16	96	7	0.66
						14	0.63
		03	04			No sample received	
			07			No sample received	
			10	16	72	8	0.90
						15	0.75
			14	16	96	8	0.59
						15	0.47
			18	16	96	6	0.40
						13	0.36
			21	16	72	8	0.27
						15	0.22
Honolulu, Hawaii 095	60	02	15	18	72	3	<0.10
			16	18	24	3	<0.10
			17	18	24	6	<0.10
			18	18	24	6	<0.10
			19	18	24	4	<0.10

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*At time of measurement

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TABLE V.—GROSS BETA RADIOACTIVITY OF PARTICULATES IN AIR—Con.

PHS Radiation Surveillance Network

Station location	End of collection (Greenwich mean time)				Sampling period, hours	Days after collection	$\frac{\mu\mu c}{M^3}$*
	Yr.	Mo.	Day	Hr.			
Honolulu, Hawaii 095—Con.			23	18	96	3	0.28
						10	0.21
			24	18	24	6	0.27
						13	0.24
			25	18	24	5	0.20
						12	0.22
			26	18	24	4	0.33
						11	0.27
			29	18	72	4	0.27
						11	0.26
		03	01	18	24	3	0.29
						10	0.23
			02	18	24	5	0.18
						12	0.13
			03	18	24	4	0.36
						11	0.25
			04	18	24	3	<0.10
			07	18	72	3	0.37
						10	0.30
			08	18	24	3	0.69
						10	0.56
			09	18	24	5	0.69
						12	0.59
			10	18	24	4	0.86
						11	0.68
			11	18	24	3	0.54
						10	0.49
			14	18	72	3	0.25
						10	0.20
			15	18	24	3	0.36
						10	0.30
			16	18	24	6	0.32
						13	0.30
			17	18	24	5	0.27
						12	0.27
Silver Hill, Maryland T-000	60	02	17	13	24	6	0.11
						13	0.11
			18	13	24	5	0.19
						12	0.19
			19	13	24	4	0.10
						11	0.11
			20	13	24	4	0.13
						11	0.15
			21	13	24	3	0.11
						10	0.11
			22	13	24	3	0.32
						10	0.20
			23	13	24	3	0.15
						10	0.16
			24	13	24	6	0.15
						13	0.11
			25	13	24	5	0.15
						12	0.15
			26	13	24	4	<0.10
			27	13	24	3	<0.10

*At time of measurement.

TABLE V.—GROSS BETA RADIOACTIVITY OF PARTICULATES IN AIR—Con.

PHS Radiation Surveillance Network

Station location	End of collection (Greenwich mean time)				Sampling period, hours	Days after collection	$\frac{\mu\mu c}{M^{3}}$*
	Yr.	Mo.	Day	Hr.			
Metropolis, Illinois T-001	60	02	16	16	24	10	0.10
						17	<0.10
			17	16	24	9	<0.10
			18	16	24	8	<0.10
			19	16	24	7	<0.10
			20	16	24	6	0.10
						13	<0.10
			21	16	24	5	0.44
						12	0.29
			22	16	24	4	0.12
						11	0.16
			23	16	24	4	0.15
						11	0.13
			24	16	24	3	0.15
						10	0.13
			25	16	24	11	<0.10
			26	16	24	10	<0.10

*At time of measurement.

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SECTION III

WATER

PUBLIC HEALTH SERVICE NATIONAL WATER QUALITY NETWORK

The National Water Quality Network was established under the provisions of Section 4(c) of Public Law 660, which states that ". . . the Surgeon General shall . . . collect and disseminate basic data . . . (relating) to water pollution and the prevention and control thereof."

This Network, operated in cooperation with State and local health agencies, was started in October 1957. At present there are 64 sampling stations located on major waterways used for public water supply, propagation of fish and wildlife, recreational purposes, and for agricultural, industrial and other uses; some of these stations are interstate, coastal, and International Boundary waters, and waters on which activities of the Federal Government may have an impact. Ultimately a total of 250 to 300 stations will be operated. A few of the more recently established stations have not yet begun to report radioactivity.

Samples of water are examined for chemical, physical, and biological quality insofar as these relate to pollution. Samples for some determinations are taken weekly, others monthly, and for some continuous composite samples of 10 to 15 days are obtained. Radioactivity determinations are made on single samples, taken weekly.

Gross alpha and beta measurements are made on both suspended and dissolved solids in the raw surface water samples. The radioactivity levels of dissolved solids provide a rough measure of the levels which may be found in a treated water, where such water treatment removes substantially all of the suspended matter. Naturally occurring radioactive substances in the environment are the source of essentially all of the alpha activity. The contamination of the environment from man-made sources is the major contributor to the beta activity. The results are reported in micromicrocuries per liter, and are shown for each station on a given river.

While beta determinations for the first two years of the Network operation have been done on each sample weekly, the alpha determinations are reported generally on a composite sample of more than one week. Beginning with samples taken in January 1960, beta determinations are to be performed on composite samples obtained by combining two weekly samples. The alpha data will be reported on three-month composite samples, with 1/3 of the stations being covered each month. All the data reported below represent the average of all information available for the month indicated.

Strontium-90 data are reported as being the results of determinations on composite sample for a three-month period ending in the month shown.

Additional information and data may be obtained from the following sources:

1. "National Water Quality Network Annual Compilation of Data," PHS Publication. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price $1.50.

2. "Report on National Water Quality Control Network," submitted by Dr. F. J. Weber, Chief, Division of Radiological Health, PHS, to Joint Committee on Atomic Energy Hearings on Fallout from Nuclear Weapons Tests, Vol. 1, May 1959, pages 167-169.

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FIGURE 3

PHS National Water Quality Network

SAMPLING STATIONS

1958-1959

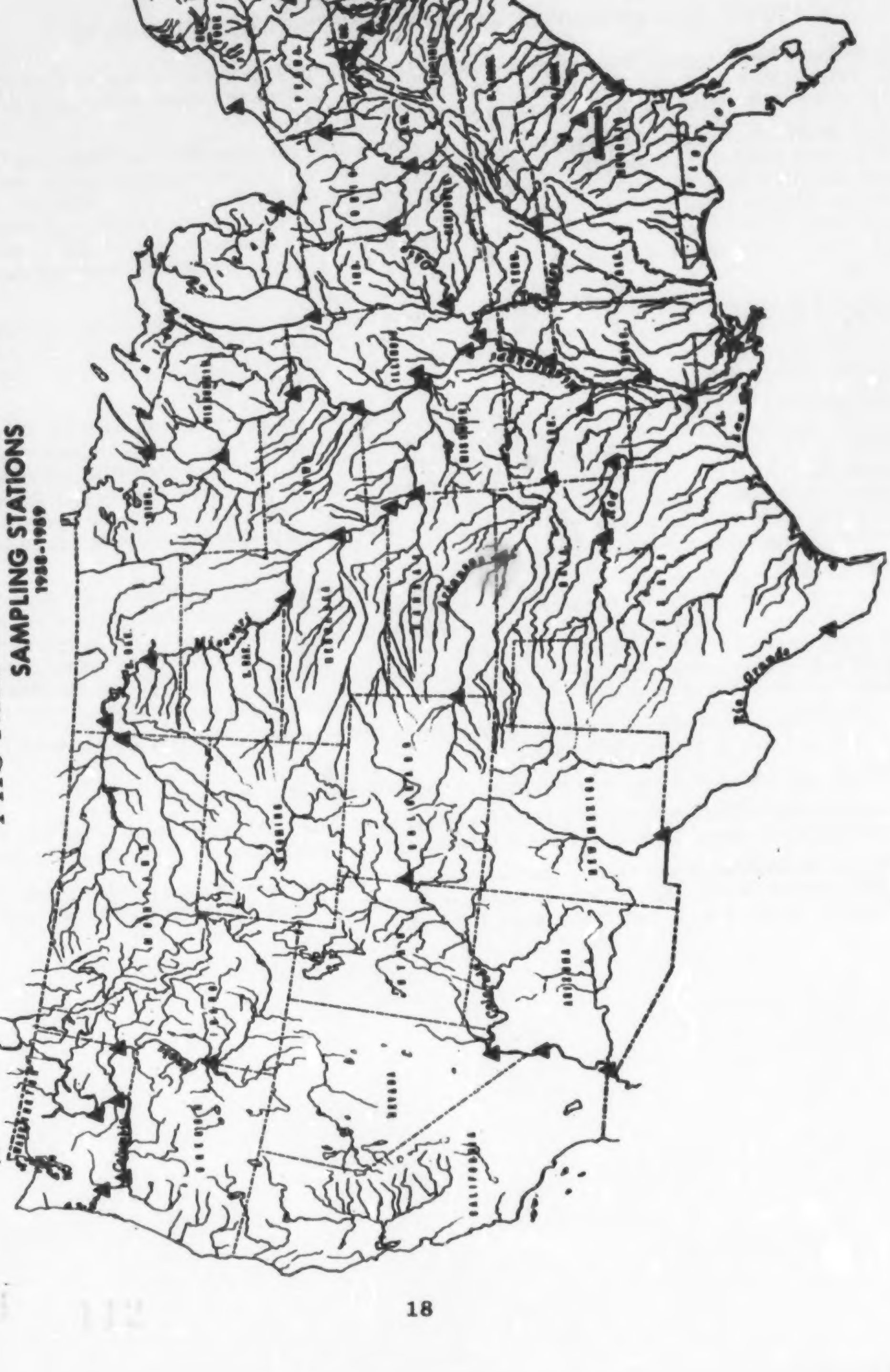

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TABLE VI.—PUBLIC HEALTH SERVICE NATIONAL WATER QUALITY NETWORK RADIOACTIVITY IN RAW SURFACE WATERS

(Micromicrocuries per liter)

Station	Quarter ending 12/31/59	Month of December, 1959 (Average to nearest whole number)					
	Strontium-90	Beta activity			Alpha activity		
		Susp.	Dis.	Tot.	Susp.	Dis.	Tot.
ALSEA RIVER							
Alsea, Oreg.	0.2	<1	<1	<1	0	0	0
ARKANSAS RIVER							
Coolidge, Kans.	0.4	0	0	0	3	36	39
Ponca City, Okla.	0.6	6	6	12	1	0	1
Fort Smith, Ark.	1.2	-	-	-	-	-	-
Pendleton Ferry, Ark.	0.6	2	0	2	-	-	-
CHATTAHOOCHIE RIVER							
Columbus, Ga.	0.2	<1	0	<1	-	-	-
COLORADO RIVER							
Loma, Colo.	0.3	0	8	8	1	12	13
Page, Ariz.	0.3	26	14	40	19	10	29
Hoover Dam, Ariz.-Nev.	0.7	0	2	2	0	7	7
Parker Dam, Ariz.-Calif.	0.7	2	10	12	0	7	7
Yuma, Ariz.	0.6	0	0	0	-	-	-
COLUMBIA RIVER							
Wenatchee, Wash.	0.8	0	1	1	-	-	-
Pasco, Wash.	0.9	84	711	795	0	0	0
Bonneville Dam, Oreg.	1.0	33	295	328	-	-	-
Clatskanie, Oreg.	0.5	30	167	197	-	-	-
CONNECTICUT RIVER							
Northfield, Mass.	0.3	<1	0	<1	0	0	0
DELAWARE RIVER							
Philadelphia, Pa.	0.6	0	0	0	-	-	-
GREAT LAKES							
Gary, Ind.	0.4	1	2	3	0	0	0
Duluth, Minn.	0.3	<1	0	<1	0	0	0
Detroit, Mich.	0.7	<1	2	2	0	0	0
Buffalo, N. Y.	1.1	4	6	10	0	0	0
HUDSON RIVER							
Poughkeepsie, N. Y.	1.3	2	0	2	1	0	1
MERRIMACK RIVER							
Lowell, Mass.	0.5	2	1	3	1	0	1
MISSISSIPPI RIVER							
Red Wing, Minn.	0.7	0	2	2	0	0	0
Dubuque, Iowa	0.4	0	4	4	0	1	1
Burlington, Iowa	1.0	0	2	2	1	0	1
East St. Louis, Ill.	0.5	0	2	2	0	1	1
Cape Girardeau, Mo.	0.4	7	6	13	1	1	2
West Memphis, Ark.	1.3	1	0	1	2	1	3
Delta, La.	1.0	6	3	9	3	1	4
New Orleans, La.	0.9	5	1	6	2	0	2

TABLE VI.—PUBLIC HEALTH SERVICE NATIONAL WATER QUALITY NETWORK RADIOACTIVITY IN RAW SURFACE WATERS—Con.

(Micromicrocuries per liter)

Station	Quarter ending 12/31/59	Month of December, 1959 (Average to nearest whole number)					
	Strontium-90	Beta activity			Alpha activity		
		Susp.	Dis.	Tot.	Susp.	Dis.	Tot.
MISSOURI RIVER							
Williston, N. Dak.	0.5	0	0	0	1	2	3
Bismarck, N. Dak.	0.9	6	8	14	0	0	0
Yankton, S. Dak.	0.5	1	12	13	-	-	-
Omaha, Nebr.	1.0	< 1	4	5	1	4	5
St. Joseph, Mo.	0.4	2	0	2	0	4	4
Kansas City, Kans.	0.7	6	6	12	-	-	-
St. Louis, Mo.	0.6	6	18	24	4	4	8
OHIO RIVER							
East Liverpool, Ohio	0.6	11	0	11	3	0	3
Huntington, W. Va.	0.2	4	0	4	1	0	1
Cincinnati, Ohio	0.8	13	1	14	2	0	2
Cairo, Ill.	1.2	12	2	14	4	0	4
POTOMAC RIVER							
Williamsport, Md.	0.5	0	0	0	-	-	-
Great Falls, Md.	0.4	1	4	5	0	0	0
RED RIVER							
Denison, Tex.	1.9	7	14	21	0	1	1
Index, Ark.	0.9	0	4	4	1	2	3
Alexandria, La.	1.6	1	12	13	0	2	2
RIO GRANDE RIVER							
Laredo, Tex.	0.7	0	0	0	2	2	4
Brownsville, Tex.	0.3	16	14	30	-	-	-
ST. MARY'S RIVER							
Sault Ste. Marie, Mich.	0.3	0	< 1	< 1	0	0	0
SAVANNAH RIVER							
North Augusta, S. C.	0.7	0	4	4	-	-	-
Port Wentworth, Ga.	0.7	< 1	3	4	-	-	-
SNAKE RIVER							
Wawawai, Wash.	0.4	0	4	4	-	-	-
TENNESSEE RIVER							
Chattanooga, Tenn.	1.1	2	53	55	0	1	1
YELLOWSTONE RIVER							
Sidney, Mont.	0.7	5	24	29	-	-	-

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PUBLIC HEALTH SERVICE—U. S. COAST GUARD

CISTERN WATER SAMPLES

Monthly samples of several roof-collected U. S. Coast Guard rain water cistern supplies are routinely analyzed for beta activity by the Robert A. Taft Sanitary Engineering Center, Public Health Service, Cincinnati, Ohio. Some samples are composited each three months and further analyzed for strontium-90 activity. Additional data concerning this investigation appears in "Statement on New Data on Uptake in Milk, Food and Human Bone," by C. P. Straub, submitted to Joint Committee Hearings on Fallout from Nuclear Weapons, May 1959, Vol. II, page 990.

Reference of this survey appears under letter H of the Selected List of Environmental Sampling Programs for Radioactivity in Water in this publication.

COAST GUARD CISTERN SAMPLES

Location	Date		Solids-ppm		Beta activity-($\mu\mu$c/l)	
	Collected	Counted	Susp.	Diss.	Diss.	Total
Swansboro	10/27/59	11/4	14	96	39	47
Metomkin	10/26	11/4	14	32	25	33
Cobb Island	10/30	11/4	2	53	36	47
Cape Hatteras	10/28	11/4	8	36	14	28
Cuckolds	10/28	11/30	21	71	15	15
Moosepeak	10/31	11/30	18	322	38	43
Cape Flattery	11/6	11/30	20	46	18	49
Patos Island	11/1	11/30	29	73	8	9
Grand Isle	11/4	11/30	16	60	4	4
Port O'Conner	11/20	12/2	16	72	16	25
Kwajalein	10/15	12/2	9	48	10	19
Cocos Island, Marianas, Guam	10/9	12/1	15	101	20	24
French Frigate, Shoals	10/15	12/1	21	456	51	72
Iowa Jima	10/26	12/1	13	51	7	7
Catanduanes, Panay Island, R. P.	10/15	12/1	12	78	4	4
Wake Island	10/8	12/2	16	224	24	27

A SELECTED LIST OF ENVIRONMENTAL SAMPLING

Type of sample	Operating agency	Sponsoring agency	Where sampled	Number of stations	Frequency of sampling	Year established
A. Rainfall (pots and funnels)	Health and Safety Lab., AEC	AEC	Worldwide	121	Monthly	1954
B. Rainfall (washtubs)	Health and Safety Lab., AEC	AEC	U.S. (3 stations) and New Zealand (1 station)	4	Each rain	1955
C. Rainfall	USPHS Radiation Surveillance Network	AEC*	U.S.	37	Daily	1956
D. Rainfall, snow	Air Force Cambridge Research Center	AEC/DOD	76°N to 41°S	6	Biweekly, selected individual rains	1956
E. Rain, snow, sleet, hail	USPHS	USPHS	Cincinnati	1	Each precipitation	1958
F. Surface water	USPHS	USPHS	Ohio River at Cincinnati	1	Monthly	1956
G. Rain, snow	Mount Washington Observatory	AEC	New Hampshire	1	Each rainfall	1958
H. Cistern water	USPHS	USPHS	USCG Stations in U. S.	10	Monthly	1957
I. Cistern water	USPHS	USPHS	Cincinnati	1	Monthly	1957
J. Surface water	USPHS	USPHS	U.S.	55	Weekly composite	1957
K. Precipitation	USPHS National Air Sampling Network	U. S. Weather Bureau	Weather Bureau Stations	About 6	Monthly	1959
L. Tap water	HASL	HASL, AEC	New York City	1	Monthly	1954
M. Tap water	Tracerlab, Inc.	HASL, AEC	Richmond, California	1	Monthly	1958
N. Surface water	USPHS and 8 cooperating agencies	USPHS	Animas River Colorado-New Mexico	6	Intermittent	1958

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* To be supplied entirely by USPHS in near future.

PROGRAMS FOR RADIOACTIVITY IN WATER

Principal in charge	Radioactivity analysis				Supplementary analysis
	Gross radiation	Fission products	Tracers	Natural activity	
Dr. John Harley HASL, AEC	Beta	Sr-90, Sr-89	W-185		Amount of rainfall
J. Z. Holland AEC, Wash., D.C.	Beta	Sr-90, Sr-89, BA-140, (Cs-137, New Zealand)	W-185 (Except New Zealand)		Solubility
H. J. Rechen, Jr.	Beta				
Dr. E. Martell	Gamma (Bedford)	Sr-90, Sr-89 (Ba-140, Bedford Jan. '58-Apr. '59)	W-185	Be-7, P-32 P-33, S-35 (Bedford, beginning 1960)	
Dr. L. R. Setter	Beta	Sr-90			
Dr. L. R. Setter	Beta				
Dr. Luis Aldaz		Sr-90			Type of precipitation
Dr. L. R. Setter	Beta	Sr-90			
Dr. L. R. Setter	Beta	Sr-90			
Dr. L. R. Setter	Beta and gamma (Same for alpha)	A few for Sr-90 and Sr-89			
Dr. L. R. Setter	Beta	Sr-90 (3 month composite)			
Dr. John Harley		Sr-90			
		Sr-90, Sr-89			
	Alpha and Beta				Dissolved radium in river water and water supplies, radium content of river muds, fish samples, algae. Gross radioactivity of river mud, river water, water supplies and algae. Sr-90 content selected foods.

METHODS OF PUBLICATION OF DATA

A. Health and Safety Laboratory, AEC (Pots)

HASL-42 U. S. Atomic Energy Commission, "Environmental Contamination From Weapons Tests," October 1958.

HASL-55 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," February 2, 1959.

HASL-65 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," May 29, 1959.

HASL-69 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," October 1, 1959.

HASL-77 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," January 1, 1960.

*HASL-84 U. S. Atomic Energy Commission, "Fallout Program, Summary Report," April 1960.

U. S. Atomic Energy Commission Quarterly Statements on Fallout.

"Summary of Analytical Results from the HASL Strontium Program July through December 1956," by J. H. Harley, E. P. Hardy, Jr., I. B. Whitney and M. Eisenbud. NYO-4751 (1956) Technical Information Service Extension, Oak Ridge, Tennessee. Reprinted in Joint Committee on Atomic Energy Hearings on Fallout, May 1957, Vol. I, pages 591-610.

"Measurement of Strontium-90 in Geophysical and Biological Materials," Statement of Merril Eisenbud, Manager, New York Operations Office, Atomic Energy Commission. Submitted to Joint Committee on Atomic Energy Hearings on Fallout, May 1957, Vol. I, page 554.

"Data on the Deposition of Strontium-90 During 1958." By J. H. Harley, E. P. Hardy, Jr., S. Klein and S. A. Lough. Reprinted in Joint Committee on Atomic Energy Hearings on Fallout, May 1959, Vol. I, page 373.

B. Health and Safety Laboratory AEC (Wash tubs)

HASL-42 U. S. Atomic Energy Commission, "Environmental Contamination from Weapons Tests," October 1958.

HASL-55 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," February 2, 1959.

HASL-65 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," May 29, 1959.

HASL-69 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," October 1, 1959.

HASL-77 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," January 1, 1960.

HASL-84 U. S. Atomic Energy Commission, "Fallout Program, Quarterly Summary Report," April 1960.

U. S. Atomic Energy Commission Quarterly Statements on Fallout.

C. USPHS Radiation Surveillance Network

1. USPHS Distribution List.
2. Joint Committee on Atomic Energy Congressional Hearings on Radioactive Fallout, May 1957.
3. U. S. Atomic Energy Commission Quarterly Statements on Fallout.
4. U. S. Department of Health, Education, and Welfare Monthly Reports on Radiological Health Data.

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*Health and Safety Laboratory Fallout Program Quarterly Summary Report, April 1960, available from the Office of Technical Services, Department of Commerce, Washington 25, D. C. for $3.50.

D. U. S. Air Force Cambridge Research Center

"Natural Aerosols and Nuclear Debris Studies, Progress Report I." By P. J. Drevinsky, C. E. Junge, I. H. Blifford, Jr., M. I. Kalkstein and E. A. Martell. September 1958.

"Natural Aerosols and Nuclear Debris Studies, Progress Report II." By M. I. Kalkstein, P. J. Drevinsky, E. A. Martell, C. W. Chagnon, J. E. Manson, and C. E. Junge.

"Atmosphere Aspects of Strontium-90 Fallout." By E. A. Martell. Science, 129, 1197 (1959).

E. U. S. Public Health Service (Rain, Snow, Sleet, Hail)

1. "Statement on New Data on Uptake on Milk, Food and Bone." By Dr. C. P. Straub. Presented at Joint Committee on Atomic Energy Hearings on Fallout in May 1959, Volume 2, page 949.
2. "The Distribution of Radioactivity from Rain." By L. R. Setter and Dr. C. P. Straub. Trans Am. Geophysical Union, 39 (3): 451-458 (June 1958).
3. "The Radioactive Contamination of the Environment in the Cincinnati Area." By L. R. Setter and H. H. Russell. J. Am. Water Works Assn., 51 (4): 449-462 (April 1959).
4. "Measurement of Low-Level Radioactivity in Water." By L. R. Setter and A. S. Goldin. J. Am. Water Works Assn., 48, 1373 (1956). Available from SEC on request. Reprinted in Joint Committee on Atomic Energy Hearings on Fallout in May 1959, Volume 2, page 1045.

F. U. S. Public Health Service (Cincinnati Surface Water)

Statement of Dr. Conrad F. Straub, Sanitary Engineering Center, Public Health Service, Cincinnati, Ohio, before the Joint Committee on Atomic Energy Fallout Hearings, May 1959, Vol. 2, page 990.

G. Mount Washington Observatory

HASL-65 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," May 29, 1959.

HASL-69 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," October 1, 1959.

HASL-77 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," January 1, 1960.

H. U. S. Public Health Service—U. S. Coast Guard (Cistern Samples)

"Statement on New Data on Uptake in Milk, Food and Human Bone," by C. P. Straub, submitted to Joint Committee Hearings on Fallout from Nuclear Weapons, May 1959, Vol. II, page 990.

I. U. S. Public Health Service (Cistern Water)

1. "Statement on New Data on Uptake on Milk, Food and Bone." Dr. C. P. Straub. Presented at Joint Committee on Atomic Energy Hearings on Fallout in May 1959, Volume 2, page 949.
2. "Measurement of Low-Level Radioactivity in Water." By L. R. Setter and A. S. Goldin. J. Am. Water Works Assn. 48, 1373 (1956). Available from SEC on request. Reprinted in Joint Committee on Atomic Energy Hearings on Fallout in May 1959, Volume 2, page 1045.
3. "The Determination of Alpha and Beta Radioactivity in Surface and Ground Water and in Fresh Water Biota." By J. S. Nader, L. R. Setter and A. S. Goldin. USAEC Doc. Wash-129, page 184 (1952).

J. U. S. Public Health Service National Water Quality Network

1. "National Water Quality Network," Annual Compilation of Data, October 1, 1957 to September 30, 1958. USPHS Publication No. 633 (1958).

2. "Radioactivity of Surface Waters in the United States." L. R. Setter, J. E. Rignier and E. A. Diephaus. J. Am. Water Works Assn. Vol. 51, No. 11, November 1959.
3. "Radioactivity in Surface Water." By H. P. Kramer, D. W. Moeller and D. A. Pecsok, J. Am. Water Assn., Vol. 50, No. 11, November 1958.
4. "Statement on New Data on Uptake on Milk, Food and Bone." Dr. C. P. Straub. Presented at Joint Committee on Atomic Energy Hearings on Fallout in May 1959, Vol. 2, page 949.
5. "Determination of Gross Radioactivity in Water, Silt, and Biological Materials." Prepared by RHRA, DRH, Robert A. Taft Sanitary Engineering Center, USPHS, Cincinnati, Ohio. Presented at Joint Committee on Atomic Energy Hearings on Fallout in May 1959, Vol. 2, page 1005.
6. "Limitations in the Use of the End-Window Counter in the Assaying of Streams for Beta Radioactivity." By L. R. Setter, J. S. Nader and G. R. Hagee. USAEC Doc. Wash-129, page 165 (1952). Available from SEC on request.
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9. "Radioactivity Assay of Water and Industrial Wastes with Internal Proportional Counter." By L. R. Setter, A. S. Goldin and J. S. Nader. Anal. Chem. 26, 1304 (1954).
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K. U. S. Public Health Service—Cincinnati

Preliminary Pilot Study—not yet available.

L. Health and Safety Laboratory AEC (Tap Water)

HASL-42 U. S. Atomic Energy Commission, "Environmental Contamination from Weapons Tests," October 1958.

HASL-55 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," February 2, 1959.

HASL-65 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," May 29, 1959.

HASL-69 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," October 1, 1959.

HASL-77 U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," January 1, 1960.

HASL-84 U. S. Atomic Energy Commission, "Fallout Program, Quarterly Summary Report,"April 1960.

U. S. Atomic Energy Commission Quarterly Statements on Fallout.

M. Tracerlab, Inc., Richmond, California (Tap Water)

HASL-65, U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," May 29, 1959.

HASL-69, U. S. Atomic Energy Commission, "Strontium Program, Quarterly Summary Report," October 1, 1959.

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HASL-84, U. S. Atomic Energy Commission, "Fallout Program, Quarterly Summary Report," April 1960.

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N. U. S. Health Service (Animas River Survey)

1. "Survey of Interstate Pollution of the Animas River, Colorado-New Mexico." By E. C. Tsivoglou, S. D. Shearer, R. M. Shaw, Jr., J. D. Jones, J. B. Anderson, C. E. Sponagle and D. A. Clark. U. S. Public Health Service Report, May 1959.
2. "Survey of Interstate Pollution of the Animas River, Colorado-New Mexico, II 1959 Surveys." By E. C. Tsivoglou, S. D. Shearer, J. D. Jones, C. E. Sponagle, H. R. ahren, J. B. Anderson, and D. A. Clark. U. S. Public Health Service Report, January 1960.

SAMPLING STATION LOCATIONS

A. Health and Safety Laboratory—AEC

(Rainfall—pots and funnels)

SUMMARY—MONTHLY FALLOUT STATIONS

Total stations (11/23/59):		121
Total stations, Northern Hemisphere (11/23/59):	84	
Total stations, Southern Hemisphere (11/23/59):	37	
Number of pot stations:	40	
Number of funnel stations:	81	

MONTHLY FALLOUT STATIONS

Site	Lat. (°N)	Long. (°)
0-10°N (13 sites)		
Singapore	1	104 E
Columbia, Bogota*	5	17 W
Liberia, Monrovia	6	11 W
Nigeria, Lagos	6	3 E
Truk Island	7	152 E
Koror Island	7	135 E
Ponape Island	7	158 E
Majuro Island	7	171 E
Ceylon, Colombo	7	80 E
Canal Zone, Albrook AFB	9	80 W
Ethiopia, Addis Ababa	9	39 E
Yap Island	9° 32'	138 E
Costa Rica, Turrialba	9° 56'	84 W
10°-20°N (8 sites)		
Venezuela, Caracas	11	67 W
Thailand, Bangkok*	14	101 E
Senegal, Dakar*	15	17 W
Philippine Is., Clark AFB	15	121 E
Puerto Rico, San Juan	18	66 W
Mexico, Mexico City	19	99 W
Wake Island	19	167 E
Hawaii, Mauna Loa	19	155 W
20°-30°N (15 sites)		
Hawaii, Honolulu (University)*	21	158 W
Hawaii, Oahu (Weather Station)*	21	158 W
Hawaii, Oahu (AEC Lab)*	21	158 W
Hawaii, Lihue	22	158 W
Hong Kong	22	114 E
Taiwan, Taitung*	23	120 E
Taiwan, Tainan*	23	120 E
Taiwan, Taipei*	25	122 E
Iwo Jima	25	141 E
Pakistan, Karachi*	25	67 E
Florida, Coral Gables*	26	80 W
20°-30°N (15 sites)—Con.		
Saudi Arabia, Dhahran	26	50° 8' E
Texas, Houston*	29° 45'	95 W
Louisiana, New Orleans	30° 00'	90 W
Libya, Wheelus AFB		
30°-40°N (20 sites)		
Egypt, Cairo	31	31 E
Texas, El Paso	32	106 W
Bermuda, Kindly AFB	32	65 W
Texas, Dallas	33	97 W
Japan, Nagasaki*	33	130 E
South Carolina, W. Columbia	34	81 W
Missouri, Columbia	34	81 W
California, Los Angeles*	34	118 W
Alabama, Birmingham*	34	87 W
Lebanon, Beirut	34	36 E
Japan, Hiroshima*	34	132 E
Morocco, Sidi Slimane	34	7 W
Oklahoma, Tulsa*	36	96 W
Japan, Tachikawa, AFB	36	140 E
California, San Francisco	37	122 W
Kentucky, Louisville	38	86 W
California, Richmond*	38	122 W
Maryland, Silver Hill	39	77 W
Azores, Lajes Field	39	27 W
Colorado, Denver	39° 41'	105 W
40°-50°N (17 sites)		
Pennsylvania, Pittsburgh*	40° 27'	80 W
Utah, Salt Lake City*	41	112 W
New York, New York	41	74 W
New Jersey, Westwood	41	74 W
Italy, Rome	42	13 E
Illinois, Lemont*	42	88 W
Massachuseetts, Falmouth (Otis AFB)	42	71 W
Oregon, Medford	42	123 W

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*Pots.

A. Health and Safety Laboratory—AEC—Con.

MONTHLY FALLOUT STATIONS—Con.

Site	Lat. (°N)	Long. (°)
40°-50°N (17 sites)—Con.		
Italy, Florence	44	11 E
Italy, Milan	45	9 E
Wisconsin, Green Bay	45	88 W
Montana, Helena	47	112 W
Austria, Klagenfurt*	48	16 E
Austria, Vienna	48	16 E
Washington, Neah Bay	48	124 W
North Dakota, Williston	48	104 W
Minnesota, International Falls	49	93 W
50°-60°N (5 sites)		
Newfoundland, Goose AFB	53	60 W
Alaska, Cold Bay	55	163 W
Scotland, Prestwick	56	5 W
Alaska, Juneau	58	134 W
Norway, Oslo	59° 55'	11 E
60°-70°N (4 sites)		
Alaska, Anchorage	61	150 W
Iceland, Keflavik	64	23 W
Alaska, Fairbanks	65	148 W
Alaska, Nome	65	165 W
70°-80°N (2 sites)		
Alaska, Barrow	71	157 W
Greenland, Thule AFB	77	69 W

Site	Lat. (°S)	Long. (°)
0°-10°S (7 sites)		
Ecuador, Quito	0° 14'	79 W
Brazil, Belem	1	49 W
Kenya, Nairobi	1	37 E
Kenya, Kikuyu*	1	37 E
Canton Island	3	172 W
Brazil, Manaus*	3	60 W
Belgian Congo, Leopoldville	4	15 E

Site	Lat. (°S)	Long. (°)
10°-20°S (7 sites)		
Peru, Lima	12	77 W
Australia, Darwin*	12	131 E
Guam, Anderson AFB	13	145 E
Bolivia, La Paz	16	68 W
Fiji Is., Suva	18	178 E
Southern Rhodesia, Salisbury	18	31 E
Australia, Townsville	19	147 E
20°-30°S (10 sites)		
Brazil, Rio de Janeiro*	23	43 W
Brazil, Nova Friburgo*	23	43 W
Brazil, Sao Jose Des Campos* (State of Sao Paulo)	23	46 W
Brazil, Itaici* (State of Sao Paulo)	23	46 W
Union of South Africa, Pretoria*	26	28 E
Argentina, Tucuman	27	65 W
Australia, Brisbane*	27	153 E
Union of South Africa, Durban*	29° 52'	31 E
Brazil,		
Brazil,		
30°-40°S (7 sites)		
Australia, Perth*	32	116 E
Chile, Santiago*	33	71 W
Australia, Sydney*	34	151 E
Argentina, Bahia Blanca	35	59 W
Argentina, Buenos Aires	35	59 W
Australia, Adelaide*	35	139 E
Australia, Melbourne*	38	145 E
40°-50°S (2 sites)		
New Zealand, Wellington	41	175 E
Australia, Hobart*	43	147 E
50°-60°S (1 site)		
Argentina, Ushuaia	55	68 W

Undertermined Listings

Site

Germany, Rhein Main
Japan, Masawa AFB
Libya, Wheelus AFB

B. Health and Safety Laboratory—AEC

(Rainfall—Washtubs)

Pittsburgh, Pennsylvania
Westwood, New Jersey
Richmond, California
Gracefield, Lower Hutt, New Zealand

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*Pots.

C. **U. S. Public Health Service Radiation Surveillance Network**

Harrisburg, Pennsylvania
Washington, D. C.
Richmond, Virginia
Atlanta, Georgia
Columbia, South Carolina
Indianapolis, Indiana
Cincinnati, Ohio
Minneapolis, Minnesota
Pierre, South Dakota
New Orleans, Louisiana
Austin, Texas
El Paso, Texas
Ponca City, Oklahoma
Salt Lake City, Utah
Boise, Idaho
Anchorage, Alaska
Berkeley, California
Honolulu, Hawaii
Seattle, Washington
Fairbanks, Alaska
Albany, New York
Gastonia, North Carolina
Jacksonville, Florida
Springfield, Illinois
Lansing, Michigan
Iowa City, Iowa
Jefferson City, Missouri
Topeka, Kansas
Oklahoma City, Oklahoma
Santa Fe, New Mexico
Little Rock, Arkansas
Denver, Colorado
Helena, Montana
Los Angeles, California
Portland, Oregon
Juneau, Alaska
Providence, Rhode Island

D. **U. S. Air Force Cambridge Research Center**

(1958-1959 Stations)

Thule, Greenland	76°N	(1958-1959)
Bedford, Massachusetts	42°N	
San Juan, Puerto Rico	18°N	(1958-1959)
Iquitos, Peru	3.5°S	
Porto Alegre, Brazil	30°S	
Puerto Montt, Chile	41°S	(1958-1959)
Selected polar areas		

E. **U. S. Public Health Service Precipitation Sampling Station**

1. Cincinnati, Ohio

F. **U. S. Public Health Service Surface Water**

2. Ohio River at Cincinnati

G. **Mount Washington Observatory Precipitation Sampling Station**

1. Mount Washington, New Hampshire

H. **U. S. Public Health Service** (Cistern Water)

Samples are collected for the following U. S. Coast Guard Stations:

Moosepeak
Cobb Island
Swansboro
Grand Isle
Patos Island
Cuckolds
Cape Flattery
Port O'Conner
Metomkin Inlet
Cape Hatteras

I. **U. S. Public Health Service** (Cistern Water)

1. Cincinnati, Ohio

U. S. Public Health Service National Water Quality Network

ALSEA RIVER
    Alsea, Oreg.

ANIMAS RIVER
    Cedar Hill, N. Mex.

APALACHICOLA RIVER
    Chattahoochie, Fla.

ARKANSAS RIVER
    Coolidge, Kans.
    Ponca City, Okla.
    Fort Smith, Ark.
    Pendleton Ferry, Ark.

CHATTAHOOCHIE RIVER
    Columbus, Ga.

COLORADO RIVER
    Loma, Colo.
    Page, Ariz.
    Hoover Dam, Ariz.-Nev.
    Parker Dam, Ariz.-Calif.
    Yuma, Ariz.

COLUMBIA RIVER
    Wenatchee, Wash.
    Pasco, Wash.
    Bonneville Dam, Oreg.
    Clatskanie, Oreg.

CONNECTICUT RIVER
    Northfield, Mass.

DELAWARE RIVER
    Martin's Creek, Pa.
    Philadelphia, Pa.

DETROIT RIVER
    Detroit, Mich.

GREAT LAKES
    Gary, Ind.
    Duluth, Minn.
    Buffalo, N. Y.

HUDSON RIVER
    Poughkeepsie, N. Y.

ILLINOIS RIVER
    Peoria, Ill.

U. S. Public Health Service National Water Quality Network—Con.

KANAWHA RIVER
  Winfield, W. Va.

MERRIMACK RIVER
  Lowell, Mass.

MISSISSIPPI RIVER
  Red Wing, Minn.
  Dubuque, Iowa
  Burlington, Iowa
  East St. Louis, Ill.
  Cape Girardeau, Mo.
  West Memphis, Ark.
  Delta, La.
  New Orleans, La.

MISSOURI RIVER
  Williston, N. Dak.
  Bismarck, N. Dak.
  Yankton, S. Dak.
  Omaha, Nebr.

MISSOURI RIVER—Con.
  St. Joseph, Mo.
  Kansas City, Kans.
  St. Louis, Mo.

OHIO RIVER
  East Liverpool, Ohio
  Huntington, W. Va.
  Cincinnati, Ohio
  Evansville, Ind.
  Cairo, Ill.

POTOMAC RIVER
  Williamsport, Md.
  Great Falls, Md.

RED RIVER
  Denison, Tex.
  Index, Ark.
  Alexandria, La.

RIO GRANDE RIVER
  El Paso, Tex.
  Laredo, Tex.
  Brownsville, Tex.

ST. MARY'S RIVER
  Sault Ste. Marie, Mich.

SAVANNAH RIVER
  North Augusta, S. C.
  Port Wentworth, Ga.

SCHUYLKILL RIVER
  Philadelphia, Pa.

SNAKE RIVER
  Wawawai, Wash.
  Weiser, Idaho

TENNESSEE RIVER
  Chattanooga, Tenn.

YELLOWSTONE RIVER
  Sidney, Mont.

K. U. S. Public Health Service—National Air Sampling Network

  Nantucket, Mass.
  Washington, D. C.
  Cincinnati, Ohio
  Caribou, Maine
  Cape Hatteras, N. C.

L. Health and Safety Laboratory—Tap Water

  1. New York, N. Y.

M. Tracerlab, Inc.--Tap Water

  1. Richmond, Calif.

N. U. S. Public Health Service—Animas River Survey

The Animas River was sampled at six stations over a distance of about 60 miles, from a location above the Vanadium Corporation of America uranium mill (at Durango, Colorado) to Farmington, New Mexico, where it joins the San Juan River.

SECTION IV

OTHER DATA

EXTERNAL GAMMA ACTIVITY
PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

Portable survey instruments are available at the stations of the Radiation Surveillance Network and one of their uses is to record external gamma radiation. These readings are not precise, especially for measurement of low levels but they can show the presence or absence of any significant increases above background. The differences among the values shown on the following table are within the variances anticipated due to differences in normal background and in instrument response characteristics.

TABLE VIII—EXTERNAL GAMMA ACTIVITY

PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

Milliroentgens per hour—at three feet above the ground for month of January 1960

Station location	Average	Station location	Average
Alaska, Anchorage	0.01	Minnesota, Minneapolis	0.02
Alaska, Fairbanks	0.01	Mississippi, Pascagoula	(*)
Alaska, Juneau	0.02	Missouri, Jefferson City	0.01
Arizona, Phoenix	0.01	Montana, Helena	0.03
Arkansas, Little Rock	0.02	New Jersey, Trenton	0.02
California, Berkeley	(*)	New Mexico, Santa Fe	0.04
California, Los Angeles	0.01	New York, Albany	0.02
Colorado, Denver	0.02	North Carolina, Gastonia	0.02
Connecticut, Hartford	0.02	Ohio, Cincinnati	(*)
District of Columbia	0.02	Oklahoma, Oklahoma City	0.02
Florida, Jacksonville	0.02	Oklahoma, Ponca City	0.04
Georgia, Atlanta	0.02	Oregon, Portland	0.02
Hawaii, Honolulu	0.02	Pennsylvania, Harrisburg	(*)
Idaho, Boise	(*)	Rhode Island, Providence	0.02
Illinois, Springfield	(*)	South Carolina, Columbia	0.02
Indiana, Indianapolis	0.01	South Dakota, Pierre	0.02
Iowa, Iowa City	0.01	Texas, Austin	0.02
Kansas, Topeka	0.02	Texas, El Paso	0.02
Louisiana, New Orleans	0.01	Utah, Salt Lake City	0.02
Maryland, Baltimore	0.02	Virginia, Richmond	0.01
Massachusetts, Lawrence	0.02	Washington, Seattle	0.02
Michigan, Lansing	0.02	Wyoming, Cheyenne	0.02

*No data received.

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